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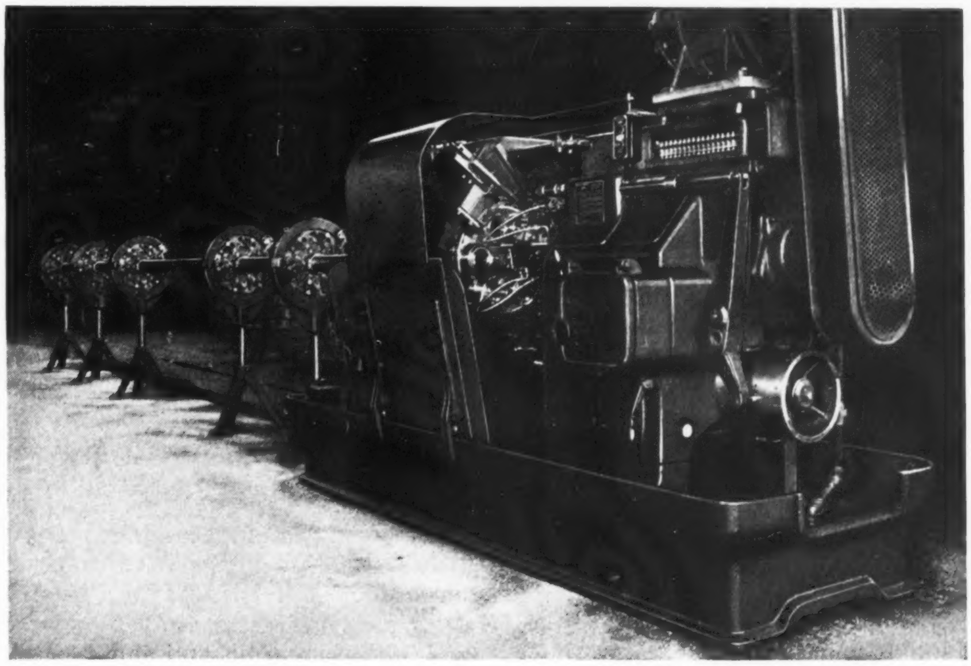
Modern Machine Tools in the Oil Industry



High-Production Operations are Common Practice in the Manufacture of Sucker Rods, Couplings, and Other Typical Parts—First of Two Articles

By CHARLES O. HERB

THE oil-producing industry is dependent upon machine tools to an extent that is not always appreciated. Wherever oil wells are being drilled, tools made by machine tools are necessary to cut through earth and rock, frequently for thousands of feet. When pipe lines are laid, miles of pipe must be threaded on machine tools, and couplings must be prepared to connect the piping. Machine tools are also essential in the manufacture of equipment used in the oil fields and around refineries, as well as in the maintenance of such equipment.

Modern types of machine tools employed in the oil industry for finishing typical parts will be discussed in this article and in a second installment to be published in December MACHINERY.

Sucker rods up to 30 feet long are machined on both ends by two Gridley bar type automatics of the design shown in the heading illustration. These machines, which were built by the National Acme Co., Cleveland, Ohio, are equipped with special six-station work-reels which support the sucker rods as they are indexed to the various working positions of the spindle-carrier. Each of the stations of these work-reels is opened automatically when it is indexed into line with the rear center position of the spindle-carrier. This permits the sucker rods to be quickly loaded into the reels and pushed

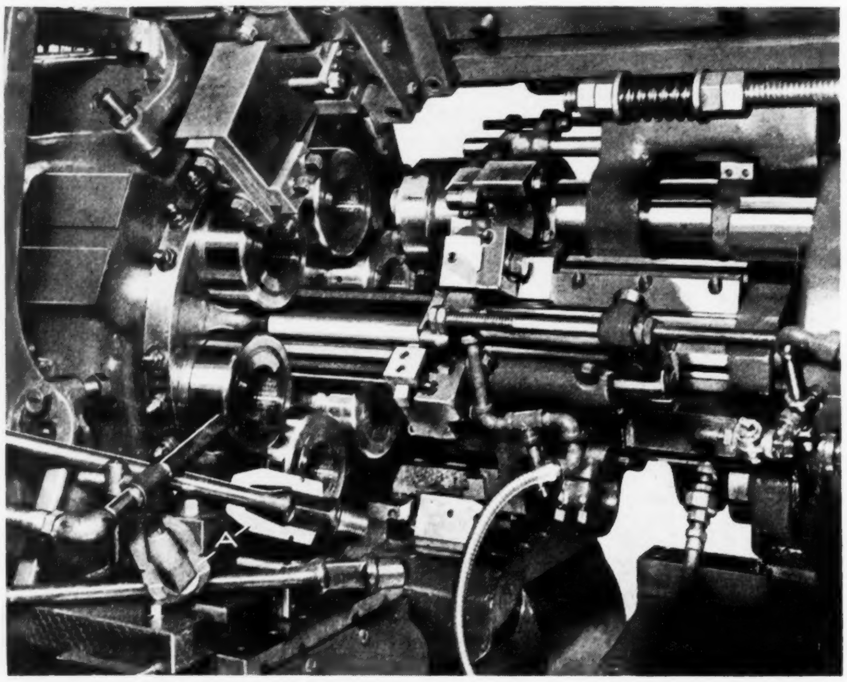


Fig. 1. Gridley Bar Type Automatic which Completely Finishes the Pin End of Long Sucker Rods that Range in Length up to 30 Feet at the Rate of 144 Rods an Hour

through the collet chucks. When finished, the sucker rods can be unloaded at this point with the same convenience. Opening and closing of the reel stations are effected by means of cam-actuated latches.

When a sucker rod has been loaded into the work-reel, a pair of split bushings *A*, Fig. 1, is placed on the square section at the end of the rod for driving purposes. The rod is then pushed completely through the collet chuck to a stop.

With the forward movement of the main tool-slide, a pusher-bar advances and pushes the sucker rod back into the collet the required distance, with the split bushings in place. The bushings are firmly gripped by the collet when it is indexed from the loading station, and through them the sucker rod is rotated until it again reaches the loading station. The collets are air-operated in the loading position.

These sucker rods are forged from 0.50 per cent carbon steel and have a hardness of 280 Brinell. The shank diameter is 7/8 inch. In machining the pin end of the sucker rod, which is the end seen in Fig. 1, the operation consists of a series of turning, forming, facing, and threading cuts, performed in the sequence shown diagrammatically in Fig. 2. The threads are cut to a diameter of 1 3/16 inches by circular chasers, mounted in an automatically opened and closed die-head which is seen in the top front position of the machine in Fig. 1. Ten threads are cut per inch. On this operation, production is maintained at the rate of one sucker rod every 25 seconds, or 144 rods an hour.

The opposite end of the sucker rod is made in the form of a socket in which a hole is drilled and tapped to the same dimensions as the threaded pin end of the sucker rods. Split bushings are employed for driving purposes on this end also, as indicated in the top diagram of Fig. 3 which shows the sequence of cuts taken on this end of the sucker rods. The operation consists of drilling, facing, counterboring, reaming, and tapping. Production on this operation is at the rate of one piece every 34 seconds, or 106 pieces an hour. When the machine was first tooled up, it was arranged for two tapping steps—roughing and finishing—as indicated in Fig. 3. However, when it was placed in operation, one tapping was found to be sufficient.

Couplings Bored at High Production Rates

A Bullard Type D Mult-Au-Matic equipped for taper-boring and recessing pipe couplings from 2 1/2- to 6-inch pipe sizes, preparing them for threading, is illustrated in Fig. 4. This job is of particular interest in that it shows the adaptability of high-production equipment to profitable operation on medium quantities. This is possible, not alone through the adaptation of the tooling to the job, but because spindle speeds and feeds for each station of the machine are independent of each other and are easily changed by pick-off gears. The proper speeds and rate of feed for each operation can be set to give maximum production, which is of particular importance in a job of this kind, where forming and boring operations are performed on the piece simultaneously.

Little time is required to change from one size of coupling to another, and only in cases where the variation in coupling size is great is it necessary to change the top jaws of the chucks or the boring-bars. When the variation is small, a change-over necessitates merely an adjustment of feeding stroke lengths and of the boring-bars.

The couplings come to the machine with one end roughed out. They are loaded at the first or chucking station, where the work-spindle is stationary. At the second station, the coupling is rough-bored for half of its depth by a single-point tool, and a beveled shoulder is cut at the bottom of the upper counterbore. The rough-boring of the coupling is completed at the third station.

The beveled shoulders and both counterbores are next finished simultaneously at the fourth station by a sidewise feeding movement of the tool-head, whereas at the previous two stations, the tools are fed straight downward for the cuts. At the fifth station, the coupling is finish taper-bored by swiveling the head to the desired angle and combining the cuts on the two tapers. Four tools are fed sidewise at the sixth station for simultaneously beveling the counterbored hole at both ends of the coupling, facing the top end, and chamfering the outer corner. Production on 4-inch couplings is forty pieces an hour on a regular operating basis.

A Gridley chucking type automatic equipped for performing similar operations on pipe couplings is illustrated in Fig. 6. This machine is equipped with two sets of chucks of three each. One set is for gripping the couplings externally for machining the first end, while the other grips the couplings internally from the finished end of the bore for machining the second end. In the operation illustrated, the couplings are 4 1/2 inches outside diameter by 6 inches long. They are bored to suit the cutting of a 2 7/8-inch pipe thread for a depth of 2 7/8 inches.

Each coupling is run through the machine twice, during which five cuts are taken on each end with a counterbore, three combination boring and counterboring tools, and a taper boring tool. A tool bit is used to chamfer the edge of the hole. The total machining time for each coupling end is 30 seconds, giving a production of 60 complete couplings an hour, machine time. An efficiency of 85 per cent is maintained in actual production.

The application of a Bullard 24-inch high-speed vertical turret lathe to the boring, facing, counter-

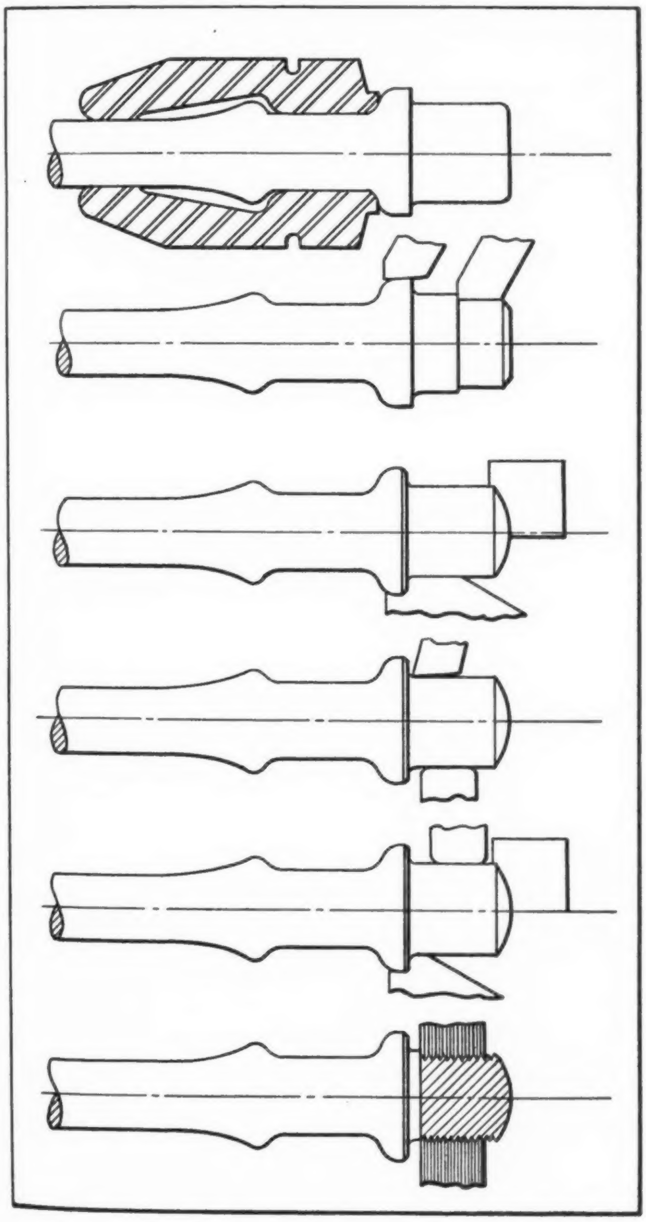


Fig. 2. Diagrams Showing Sequence of Operations Performed on Sucker Rods in the Machine Illustrated in Fig. 1

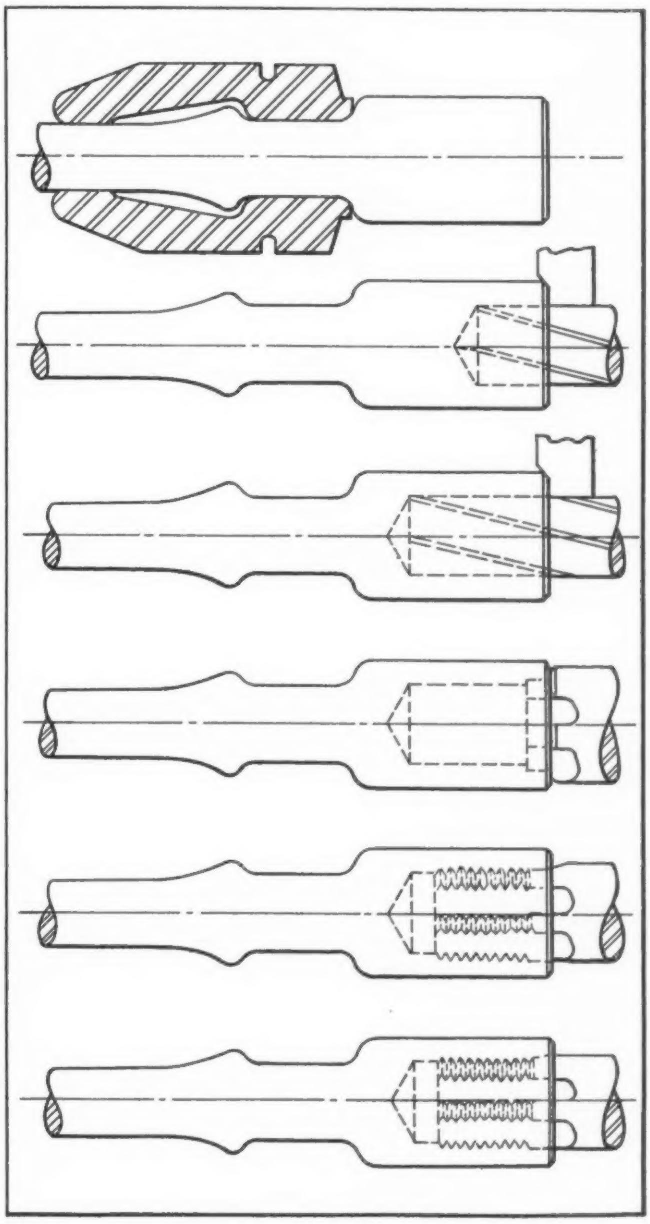


Fig. 3. Sequence of Cuts Taken by a Gridley Bar Type Automatic in Machining the Socket End of Sucker Rods

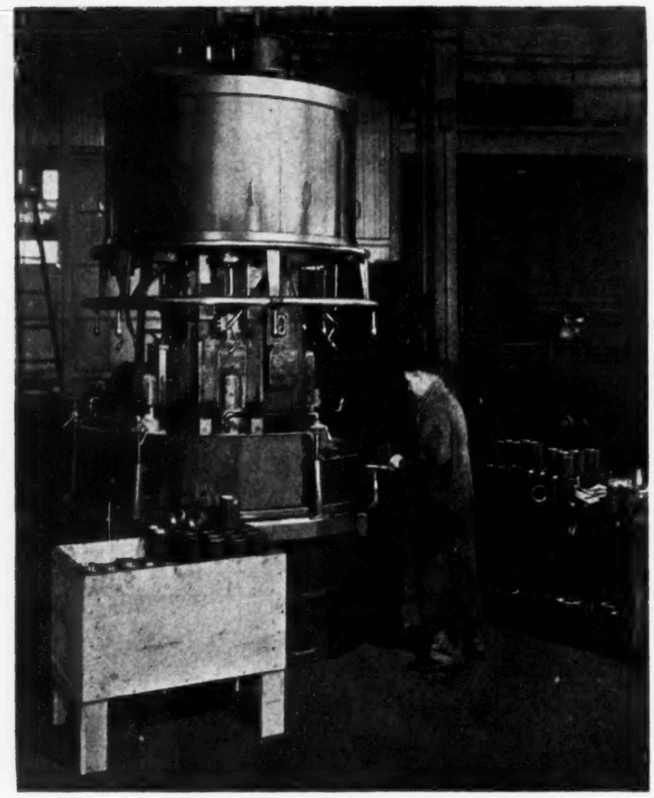


Fig. 4. Mult-Au-Matic Set-up for the High-production Boring, Facing, and Chamfering of Pipe Couplings

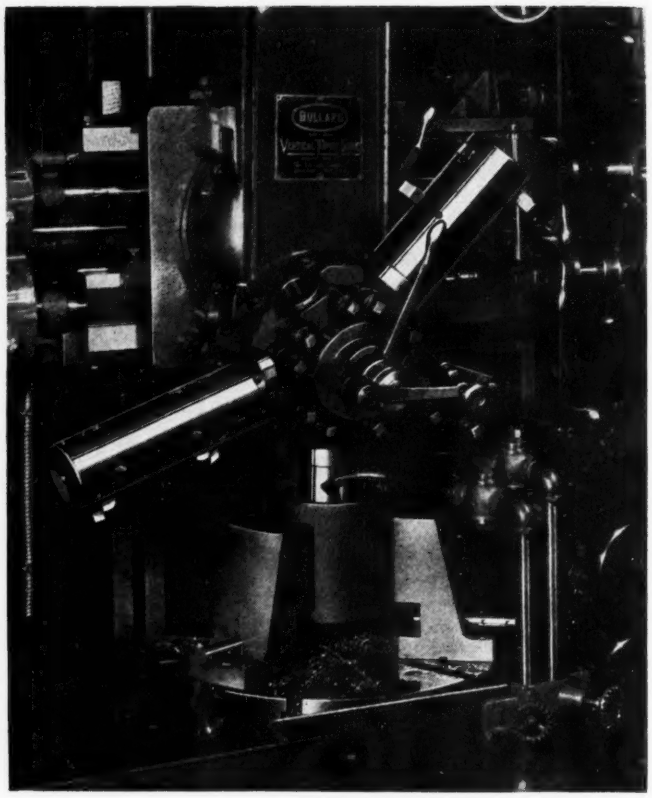


Fig. 5. Pipe Couplings are Bored to Opposing Tapers, Threaded, and Chamfered on this Vertical Turret Lathe

boring, and threading of pipe couplings is illustrated in Fig. 5. With this equipment, the turret is set at the taper angle of the internal coupling surfaces, so that the tools are fed at that angle with each vertical movement.

In the first operation, the part is bored to the required opposing tapers by means of tools on the bar seen extending to the left. One of the single-point tools used for this purpose begins cutting at the top end of the coupling and proceeds to the middle, while the other tool starts at the middle of the coupling and cuts to the bottom end.

When these cuts have been completed, the turret is raised, indexed, and again fed toward the work

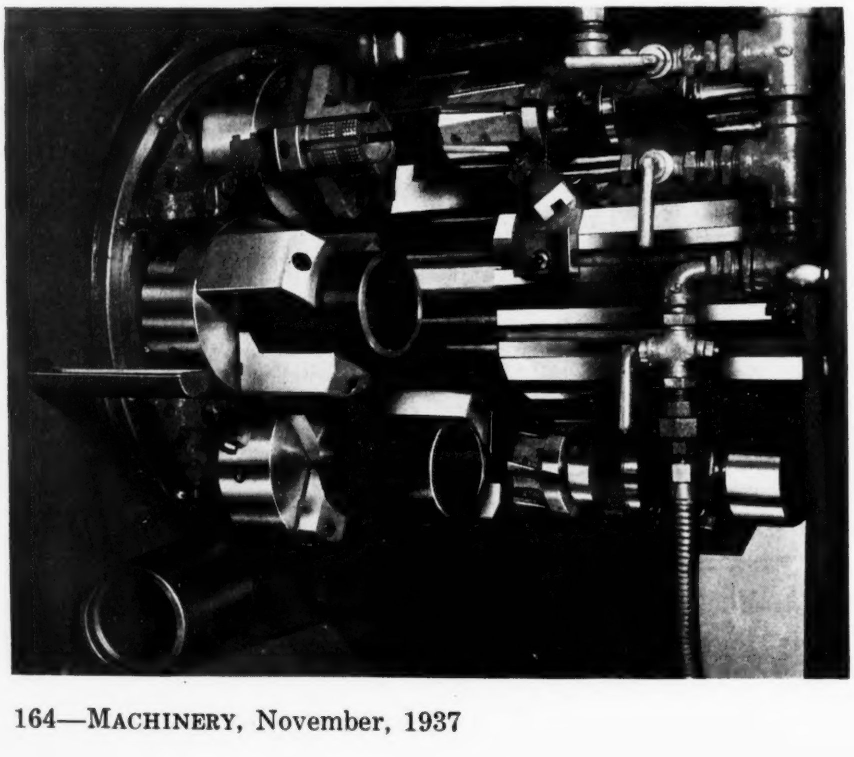


Fig. 6. Two Different Sets of Chucks in Alternate Positions on this Automatic Enable Both Ends of Couplings to be Machined in Two Passes through the Machine

for simultaneously threading the two tapered surfaces by means of two chasers. This step of the operation was in progress at the time that the photograph was taken. An important point in this operation is to make the threads match in the middle of the coupling. This is accomplished by setting the chasers the proper distance apart.

The final cuts are taken on the coupling by the tools on the mandrel seen extending upward toward the right. They consist of facing the coupling ends, and are taken by feeding the turret sidewise after the cutters have been lowered into line with the surfaces to be finished.

In the operation illustrated, couplings for 8 5/8-inch pipe are machined at a net production of 6.3 pieces an hour. The tooling of this machine can also be quickly adapted for couplings of various sizes, and the same tool-bars can be used for couplings that are closely related in size. The machine can be driven at table speeds of from 7 1/4 to 250 revolutions per minute, which makes it especially flexible for work of different sizes.

A second and final installment of this article, which will be published in December MACHINERY, will describe methods used in the oil industry for cutting threads on pipes, couplings, and other parts, and will also describe several gages designed for checking the accuracy of such threads.

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Proposed Legislation to Legalize Standard Relation between Inch and Millimeter

According to *Industrial Standardization*, when Congress adjourned late in the summer it left, among other unfinished business, a proposal to provide for a legal ratio between the inch and the millimeter. At present the legal ratio is 1 inch equals 25.40005 millimeters. It is proposed to simplify this, so that the legal inch will equal 25.4 millimeters. This simplification was approved in 1933 by the American Standards Association for use in industry.

In Great Britain, where the legal relation between the inch and millimeter is 1 inch equals 25.39998 millimeters, the simplified ratio 25.4 was adopted by industry in 1930. The rest of the world has welcomed this simple ratio of 25.4. Austria, Czechoslovakia, Denmark, Finland, Germany, Great Britain, Hungary, Italy, Japan, the Netherlands, Norway, Poland, Roumania, Russia, Sweden, and Switzerland have adopted this ratio.

* * *

Forty-Ton Crane Combined with Five-Ton Hoist Saves Costs in Press Room

Using a 40-ton overhead crane to lift automobile body dies weighing 40 tons in one thing—using it to lift small dies or light loads of sheet steel is another. In the first place, a 40-ton crane has not the lifting speeds suitable for handling light parts; secondly, there is a waste of current when a crane of this size is used for so small a fraction of its capacity.

At the Seaman Body Corporation's plant in Milwaukee, a Pawling & Harnischfeger 40-ton crane is frequently called upon to handle dies weighing from 30 to 40 tons, but 80 per cent of the lifts are for loads of less than 5 tons. A practical solution of the problem of providing for this variety in loads is indicated by the accompanying illustration. A 5-ton hoist is installed next to the crane hook. This hoist, which has a variable-speed unit, is controlled from the crane cab in the same manner as though it were an auxiliary crane hook. This method economizes on current and speeds up the handling of work and dies.

A Five-ton Hoist Used in Combination with a Forty-ton Crane for Lifting Small Dies or Other Light Loads Saves Time and Current in a Milwaukee Press Plant

What a Shop Executive Should Know About Depreciation

The Importance of a Uniform Depreciation Procedure for Each Plant, and a Suggested Method whereby Depreciation Percentages Can be Varied in Accordance with the Extent to which Machines and Tools are Used Each Year

By EUGENE CALDWELL, General Manager
Wrought Washer Mfg. Co., Milwaukee, Wis.

MORE has been written on depreciation than on any other accounting subject. Nevertheless, many businesses have no definite system for taking depreciation on plant equipment.

The first thing to do in establishing a consistent depreciation policy is to set up a plant ledger which has a separate sheet made out for each piece of equipment, so that depreciation can be taken on each separate item instead of on the entire equipment as a whole. In a few cases, one sheet must be used for an entire group of equipment as, for example, for leather belting or lineshafting. An appraisal by a regular appraisal firm is highly desirable at the time of setting up such a ledger. After the new ledger is set up, but before any depreciation is taken on the equipment, it is important that definite depreciation percentages or standards be set up.

For several years accountants in manufacturing plants have been discussing Treasury Department decision No. 4422, announced nearly three years ago. This decision was made for the admitted purpose of collecting more taxes by disallowing the depreciation taken under certain conditions. The decision provides that when a certain rate of depreciation has been taken for several years, and it is desired to increase the rate, it will be assumed that the higher rate is correct, and that it should have been taken all along. Thus the equipment is considered as depreciated to the extent of the higher rate, and inasmuch as all but the last three years are now "outlawed," that much depreciation is lost forever.

On the other hand, suppose it is desired to change to a lower rate of depreciation than has been taken in other years. Under decision No. 4422, the lower rate will be considered correct and the depreciation for the last three years, which are still open, will be disallowed and additional taxes collected. In other words, it becomes undesirable to change the rate of depreciation either up or down after it has once been established.

Consequently, it is necessary to set up a depreciation percentage or standard before starting to use the plant ledger. Without such standard, it will be impossible to follow any consistent method. The same rates can be used for similar equipment at the start, but without some standard method to be used as a guide when equipment of similar type is added in later years, different rates will inadvertently be used. Now, such inconsistency in a plant ledger will not be approved by the internal revenue auditors; and in fact, it cannot be justified by good accounting practice.

Engineers, Not Accountants, Must Determine Rate of Depreciation on Machinery

The actual rate of depreciation is something to be determined by an engineer, not by an accountant. The engineer should estimate the probable life of the equipment and establish a rate that will reduce the value to zero, or to scrap value, at the end of a given period. An ideal depreciation system would be one that would write off the value in such a manner that the equipment could be sold at any time without showing any gain or loss on the books.

In addition to the wear and tear on the equipment, depreciation should take into account all the factors tending to reduce its value as an asset, as, for example, obsolescence. If a machine is likely to become obsolete long before it is worn out, it is obvious that a higher rate of depreciation should be used.

During periods when a business is making money, a manufacturer would like to take all the depreciation allowable, as this would reduce his income and undistributed profits tax. On the other hand, when a business is operating at a loss, it would be preferable not to take any depreciation at all, for the reason that there is no income or undistributed profits tax to be paid; and any depreciation taken in such a year prevents taking depreciation for a longer period in profitable years. Obviously, the Internal Revenue Department will not permit de-

preciation to be taken in this manner; nor does good accounting or good engineering admit that depreciation depends in any way on profits.

A Rational System of Depreciation would Tie it to the Annual Production

There is, however, an acceptable system for taking depreciation that, in its effects, closely resembles that mentioned in the last paragraph; yet it has the approval of the Internal Revenue Department and certainly represents good accounting and engineering practice. Strangely enough, it is little used in industry. Under this system, depreciation rates on production equipment are varied up and down in relation to the amount of monthly or annual production. It is evident that production equipment wears out faster when a large volume of production passes through a plant than when the production rate is low. Obviously, also, the profit and loss periods of a business are fairly well tied in with the high and low production periods. When a business is losing money, the production is usually at a low point; when there are ample profits, they are usually due to the fact that production is high. When the proposed system is used, it is more important than ever that a uniform method be determined upon before recording any depreciation in the plant ledger; otherwise, there will be no consistency whatever in depreciation rates.

An Example of How Depreciation Rates May Vary with Production

As an example of a scheme of depreciation percentages varying with production which is used by a company engaged in the metal industry in the middle-western territory, the following table is presented. The expression "production unit" may obviously mean either an assembled unit, like an automobile, if we are dealing with the automobile industry, or a unit consisting, say, of 1000 kegs of washers, if we are dealing with a plant in the metal stamping industry making washers. The unit may be anything that can be conveniently compared from month to month.

Yearly Percentages of Depreciation

Production Units per Month

Item	1000	2000	4000	6000	8000	10,000
Stamping Presses	4	4½	5½	6½	8	10
Machine Tools	3	4	6	8	12	14
Shears	2	2½	4	6	8	10
Motors	3	4	6	8	10	12
Power Plant	3	4	6	8	10	12
Tumbling Barrels	2	2½	4	6	8	10
Cranes	3	4	6	8	10	12
Pulleys	3	4	6	8	10	12
Line Transmission	3	4	6	8	10	12
Dust Collector System	6½	7	8	9	10	11

It should be explained that this table is illustrative of the principle only; the actual rates used should not be taken as a recommendation of good depreciation rates for the equipment shown. These must be determined by the engineers for each individual plant; that is, the engineer will have to determine how the use of each class of equipment varies with production. For instance, the plant whose depreciation schedule is shown in the table has no machine work on its finished product. Machine tools are used only for maintenance and for building stamping tools. Obviously, in a plant where machine work is necessary on the finished product, depreciation rates on machine tools would vary greatly.

Although varying rates of depreciation in proportion to production are justified by good engineering, it would not be reasonable to try to vary the rates on all assets, because some are not affected by production. Buildings, furniture, etc., are in this class. The following tabulation represents examples of good average rates on assets not affected by production:

	Per Cent
Buildings	
Concrete	2
Brick	2 1/2
Steel	4
Frame	5
Piping, Wiring, etc.	5
Machinery Not Used in Production	7
Automobiles and Trucks	25
Furniture and Fixtures (Office Desks, etc.)	10
Typewriters, Adding Machines, etc.	16 2/3

If the plant ledger is already in use, it is still advisable to prepare a standard depreciation scheme. All new sheets when added to the plant ledger can show depreciation according to the standard adopted, and over a period of years, the plant ledger will gradually become consistent.

Production equipment, when not used, obviously does not depreciate at the same rate as when used. Some policy should be adopted which represents as nearly as possible the facts. For example, half the normal rate may be decided upon as correct for stored equipment.

Do Not Expect Perfection of Your Depreciation System

No system of depreciation ever devised is perfect. Book values should be compared frequently with the actual value of the physical property. It should be ascertained as nearly as possible if the actual remaining life of equipment is about equal to that shown on the books. An occasional professional appraisal for this purpose is always justified. When an adopted rate is found to depreciate the equipment too rapidly or too slowly, the rate should be changed. When equipment is disposed of at less than its book value, or scrapped at a loss, obviously, the depreciation rate is not correct. Otherwise, the book value would be just equal to the disposal value without either profit or loss. Proper accounting requires that the correct depreciation rate be taken for the current year. The remaining undepreciated balance, however, will be shown as a loss. To take the full correct depreciation rate for the current year has a tax-saving feature, inasmuch as

capital gains or losses in excess of $2000 are not permitted to be included for income and undistributed profits tax purposes.

An Example of the Effect of Too Small a Depreciation Rate

For example, suppose a piece of equipment costing $50,000 is depreciated at the rate of 5 per cent. This assumes a life of twenty years. Then suppose that at the end of ten years, or in December of the current year, the equipment is scrapped. At the beginning of the current year a depreciation of 45 per cent had been taken. This is equal to $22,500, leaving a book value of $27,500. Since the equipment is scrapped, however, its actual value is now equal to zero. Obviously, therefore, if the depreciation had been taken correctly, it should have been 10 per cent. Inasmuch as the current year has not yet been closed, it is correct to take $5000 as depreciation this year (part of the current expenses), leaving only $22,500 to be taken as a loss. Only $2000 of this can be considered in computing the income and undistributed profits tax, so that, obviously, in the example given, the tax on $2500 would be saved.

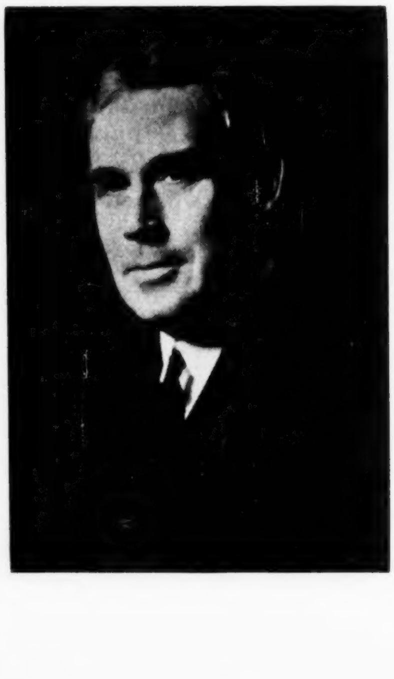
When equipment is entirely worn out and replaced during the year, this is equivalent to 100 per cent depreciation. It is foolish to capitalize such items at all. These should be charged immediately to expense. In fact, great care should be used in capitalizing assets. Conservative accounting requires that equipment be charged directly to expense if its future use is somewhat problematic. For example, tools or patterns, unless intended for permanent use, should be charged to expense on the first order, or at least should be depreciated very rapidly.

Another item to consider is that expense covering work done on designing and building of equipment should not be held long in a work-in-process account, for as long as the expense remains in this account, no depreciation can be taken. There are cases where considerable sums of money have been tied up on half completed projects for a number of years. The completion of the original plans was deferred on account of the depression and the funds have remained "frozen" in so far as depreciation is concerned.

In conclusion, the writer wishes again to emphasize that depreciation cannot be taken accurately without a plant ledger based on an adequate appraisal. No depreciation should be taken and entered in the ledger until a standard scheme or method for evaluating the depreciation has been set up.

Harvey N. Davis, New President of the A.S.M.E.

HARVEY N. DAVIS, president of Stevens Institute of Technology, has been elected president of the American Society of Mechanical Engineers for the year 1938. Dr. Davis was born in Providence, R. I., in 1881. He graduated from Brown University with an A.B. degree in 1901, and, through post-graduate work, received his A.M. degree from Brown University in 1902, and A.M. and Ph.D. degrees from Harvard University in 1903 and 1906, respectively. In 1906, New York University conferred the honorary degree of Doctor of Engineering on him. He was an instructor in mathematics at Brown University in 1901 and 1902, and later instructor in physics at Harvard. In 1910, he was appointed assistant professor of physics at Harvard, and in 1919 was made professor of mechanical engineering. He remained there until 1928, when he was elected president of Stevens Institute of Technology.



Dr. Davis became a member of the American Society of Mechanical Engineers in 1920 and a Fellow of the Society in 1936. He was appointed a manager in 1929 to fill the unexpired term of L. B. McMillan and was elected vice-president in 1930. He is at present chairman of the Meetings and Program Committee of the Society, and is a member of the Society's Advisory Board on Technology and of the United States National Committee of the International Electrotechnical Commission.

Dr. Davis has served as consulting engineer for several industrial corporations, and during the war was engaged in important research work for the Government. He has a number of inventions to his credit, including an improvement in steam turbines and processes for the liquefaction of air.

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In 1897, the federal commissioners of Washington, D. C., refused the application of a local concern to operate a motor delivery wagon, on the ground that "it would frighten horses and thus endanger life and property."

Reed-Prentice Completes Sixty-Five Years in Business

THE year 1937 marks the sixty-fifth anniversary of the Reed-Prentice Corporation, Worcester, Mass. The business was started in 1872 by Albert F. Prentice, who began to manufacture lathes and drilling machines under the name of A. F. Prentice & Co. In 1875, F. E. Reed, who had been connected with the company, purchased a half-interest in the business; and in 1877, he purchased the remainder and formed the F. E. Reed Co. Then A. F. Prentice and Vernon F. Prentice started the firm of Prentice Bros., which was consolidated with the F. E. Reed Co. in 1912 to form the present Reed-Prentice Corporation. Mr. Reed devoted his entire attention to the manufacture of lathes, which became known the world over. The Prentice Bros. firm, which had confined itself to the manufacture of drills, developed the first geared-head lathe in 1905.

In 1922, the Reed-Prentice Corporation absorbed the Whitcomb-Blaisdell Machine Tool Co., of Worcester, Mass., and the Becker Milling Machine Co., of Hyde Park, Boston, Mass. Through one of these acquisitions, the corporation actually dates back a hundred years, since one of the branches of the Whitcomb-Blaisdell organization—S. C. Coombs & Co.—was started in 1837. This firm later became Shepard & Martin Lathe, and successively, Lathe & Morse and the Draper Machine Tool Co., which latter was merged with the Whitcomb-Blaisdell Machine Tool Co. in 1905.

The Whitcomb branch of the Whitcomb-Blaisdell Machine Tool Co. started under the name of P. Whitcomb & Co. in 1849, later becoming the Whitcomb Mfg. Co., which name it retained until it was merged with the Whitcomb-Blaisdell Machine Tool Co. in 1905. The P. Blaisdell branch was established in 1865 and continued until 1905, when it was merged with the Whitcomb-Blaisdell Machine Tool Co. The Kabley Foundry, another branch of the Whitcomb-Blaisdell organization, was founded by Arnold Kabley, Alonzo Whitcomb, and F. E. Reed. W. H. Whitcomb later purchased and organized the Whitcomb Foundry, which continued until it was merged with the Whitcomb-Blaisdell Machine Tool Co. in 1905.

The Becker company was organized by John Becker in 1890. In that year Mr. Becker, a manufacturer of brass and steel stamps and stencils in Fitchburg, Mass., placed on the market the Becker milling machine. He later moved to Hyde Park, Mass., and formed the Becker-Brainard Milling Machine Co., which became the Becker Milling Machine Co. in 1915.

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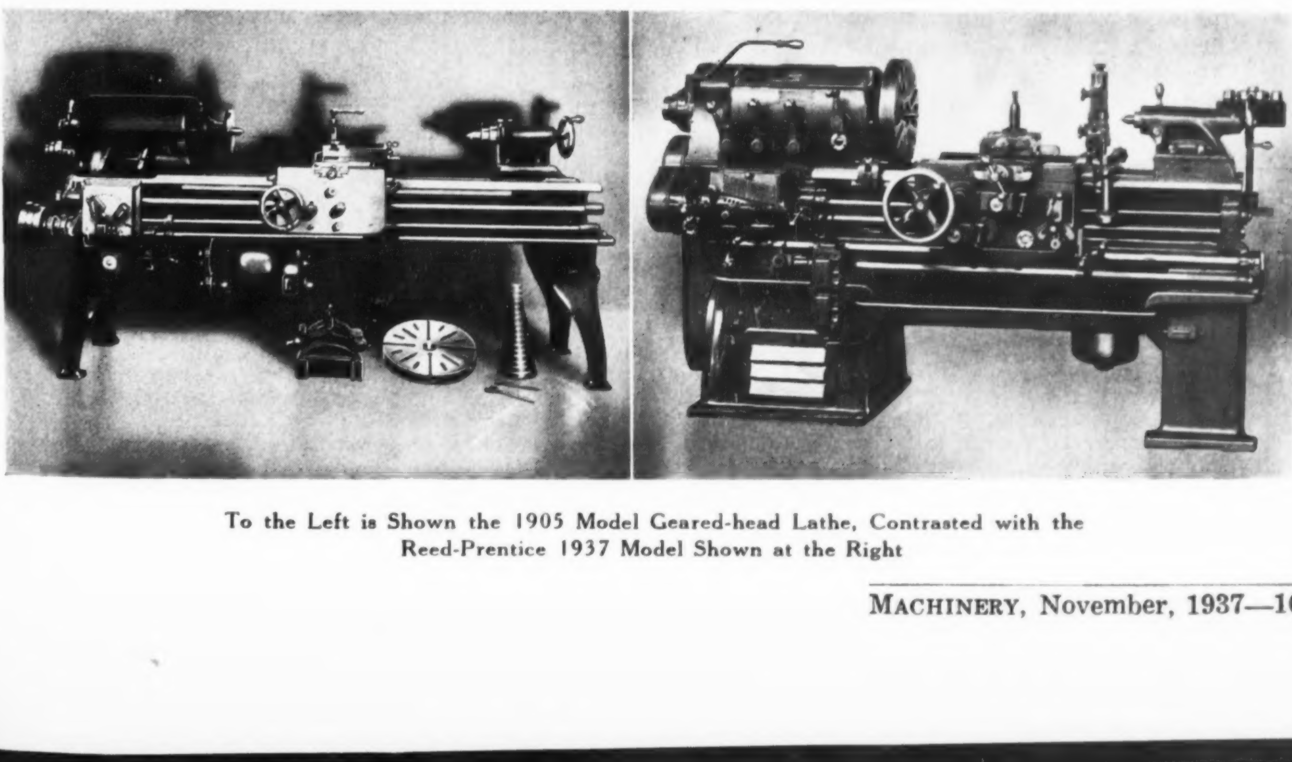
French Machine Tool Imports and Exports

The metal machinery imports into France declined slightly, and the exports increased, in 1936. German manufacturers obtained the largest share of the import trade—41 per cent in 1936, compared with 38 per cent in 1935. The share of the United States was 36 and 35 per cent, respectively. The exports of machine tools from France went chiefly to Soviet Russia, Italy, Belgium, Czechoslovakia, Poland, and the United Kingdom.



To the Left is Shown the 1905 Model Geared-head Lathe, Contrasted with the Reed-Prentice 1937 Model Shown at the Right

Present-Day Materials for Metal-Cutting Tools

A Review of the Steels, Stellites, and Carbides from which Metal-Cutting Tools are Manufactured, with Important Points on the Heat-Treatment and Grinding of Tools

By A. H. d'ARCAMBAL, Consulting Metallurgist
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Division Niles-Bement-Pond Co., Hartford, Conn.

THE majority of precision metal-cutting tools are made from high-speed steel of the 18-4-1 type. Each year sees a smaller demand for carbon steel cutting tools, partly because of the severe production requirements in our shops, and partly because of the many different kinds of materials now being machined that require high-speed steel tools.

Cobalt high-speed steel tools of both the 5 and 10 per cent cobalt types are successfully employed for turning, boring, and facing tools used on difficult machining jobs. Cobalt high-speed steel does not possess as high a degree of toughness as the 18-4-1 material; its use, therefore, is limited. Cobalt high-speed steel tools, moreover, have a fairly deep soft skin after the usual hardening operation, making it necessary to grind all surfaces after hardening to a depth of at least 0.010 or 0.015 inch, in order to insure removal of this soft skin. Coating the tools with borax before the hardening operation reduces the soft skin to a minimum, but does not insure absolute freedom from it.

The 18-4-2 grade of high-speed steel, or the so-called "double-vanadium" type, is recommended for turning tools of all kinds, as well as for cutting tools where some sacrifice in toughness is permissible. Many high-speed steel broaches are made from 18-4-2 steel; experience indicates that they give much better service than when made from 18-4-1 steel.

An appreciable tonnage of molybdenum high-speed steel containing from 8 to 9 per cent molybdenum and from 1 1/2 to 2 per cent tungsten, together with the usual percentages of chromium, vanadium, and carbon, is used today for drills, reamers, and hacksaw blades. This molybdenum high-speed steel sells for a lower price than the 18-4-1 type. Tools made from it have somewhat greater toughness after being properly hardened than tools of 18-4-1 steel. A salt bath should be employed for the hardening of molybdenum high-speed steel tools, because of the decarburization that takes place when tools of this material are hardened by the usual process, making it necessary to grind them all over after hardening.

The steel companies also market a molybdenum-vanadium high-speed steel having 2 per cent vanadium in place of the tungsten. Experiments are being conducted on a molybdenum high-speed steel containing about 1 1/2 per cent copper and a small amount of boron. It is claimed that this copper-boron-molybdenum steel will not decarburize during the usual hardening process, but it appears that this type of steel is very difficult to manufacture, and tools made from it lack the toughness of the molybdenum-tungsten and molybdenum-vanadium steels.

A western manufacturer recently has been experimenting with cast turning tools, the approximate composition being as follows: Carbon, 4 per cent; chromium, 16 per cent; nickel, 2 per cent; molybdenum, 8 per cent; cobalt, 5 per cent; and vanadium, 1 per cent. This material, as cast, has a Rockwell hardness running from C 67 to 68. Heating the cast tools to 1900 degrees F. and air-cooling them has practically no effect on the hard-

A. H. d'Arcambal, consulting metallurgist of the Pratt & Whitney Division Niles-Bement-Pond Co., and sales manager of the company's small tool and gage departments, was born in Kalamazoo, Mich., in 1890. He graduated from the University of Michigan in 1912 with the degree of Bachelor of Chemical Engineering. For six years, he was metallurgist in various automotive plants in Detroit, and in 1918, he became chief metallurgist of the Wright-Martin Aircraft Corporation. The following year he joined the Pratt & Whitney Co. and has been with that organization ever since. Mr. d'Arcambal is past-president of the American Society for Metals and is chairman of the Hartford Chapter of the Society. He is also a member of the Society of Automotive Engineers, the American Society of Tool Engineers, and the Hartford Engineers Club.

ness, but does increase resistance to wear, except when the tools are employed for machining steel running in the higher Brinell ranges, say, over 400 Brinell.

It is claimed that the method of melting this high-alloy material is of vital importance. Improper melting practice results in extreme brittleness of the product, with resultant short life. The results of tests conducted on cast tool bits, properly melted and treated, indicate that there is likely to be a wide demand for cast turning tools made of this material, if the melting practice can be so controlled as to produce a uniform product of satisfactory toughness. The three micrographs, Fig. 1, show plates of complex chromium carbide, the matrix being rich in chromium, carbon, and chromium carbides; the latter are precipitated on heat-treatment to an extent depending on the type of treatment. The remaining parts of the field apparently consist of a eutectic segregate.

Fields for Different Types of High-Speed Steel

There is a definite field for the newer types of high-speed steels, such as the molybdenum, cobalt, and double-vanadium steels. It is the author's opinion, however, that the majority of precision metal-cutting tools will continue to be made of 18-4-1 steel for some time to come. This 18 per cent tungsten high-speed steel is the most satisfactory all-around material available at present for the many different types of metal-cutting tools in daily use. Tools made from this steel have very good red-hardness properties, excellent wear-resistance, and a high degree of toughness. Another important point in favor of the 18 per cent tungsten steel is its wide hardening range and freedom from the heavy decarburization found in the cobalt and molybdenum steels when subjected to the usual hardening procedure. It may be that a new type of high-speed steel will be developed which will prove superior to the 18-4-1 type, considering that the tool steel makers are continually experimenting with new compositions in the attempt to improve present products.

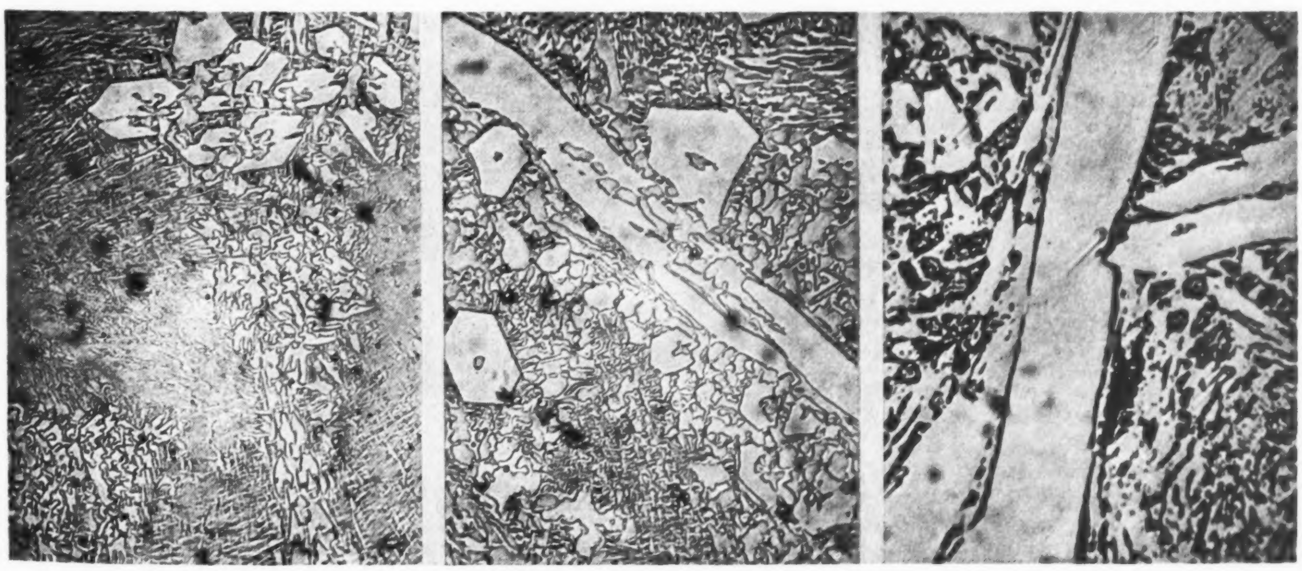
Many large users of tool steels have found it desirable to purchase carbon, alloy, and high-speed steels under properly prepared specifications covering both the desired chemical composition and physical properties. Cooperation between the steel mill and the metallurgical department of a manufacturing plant results in the preparation of tool steel specifications that are practical, at the same time assuring the manufacturer of receiving a product of a uniformly good quality for his cutting tools. All tool steel specifications should include, besides the chemical composition, Brinell hardness range, cleanliness specifications, fracture quality, and microscopic structure specifications.

The micrographs of carbon tool and high-speed steel shown in Figs. 2 to 6 compare poorly fabricated with properly melted and manufactured steel, thus illustrating the value of microscopic control in the examination of tool steels. Proper control of the quality of the various grades of tool steels employed insures satisfactory machineability, uniform response to the correct hardening treatment, and the production of high-quality cutting tools.

The Broadening Application of Cemented Carbides

The manufacturers of cemented carbides, through intensive research, have not only improved the quality of the carbide material originally introduced some nine years ago, but recently introduced several new grades. One manufacturer lists a dozen

Fig. 1. Micrographs of Cast 16 Per Cent Chromium Alloy Tool Bit. To the Left is Shown Structure near the Edge of Tool Bit before Heat-treatment; in the Center, Structure at the Center of the Tool Bit before Heat-treatment; to the Right, Structure at the Center of the Tool Bit after Heat-treating at 1900 Degrees F.

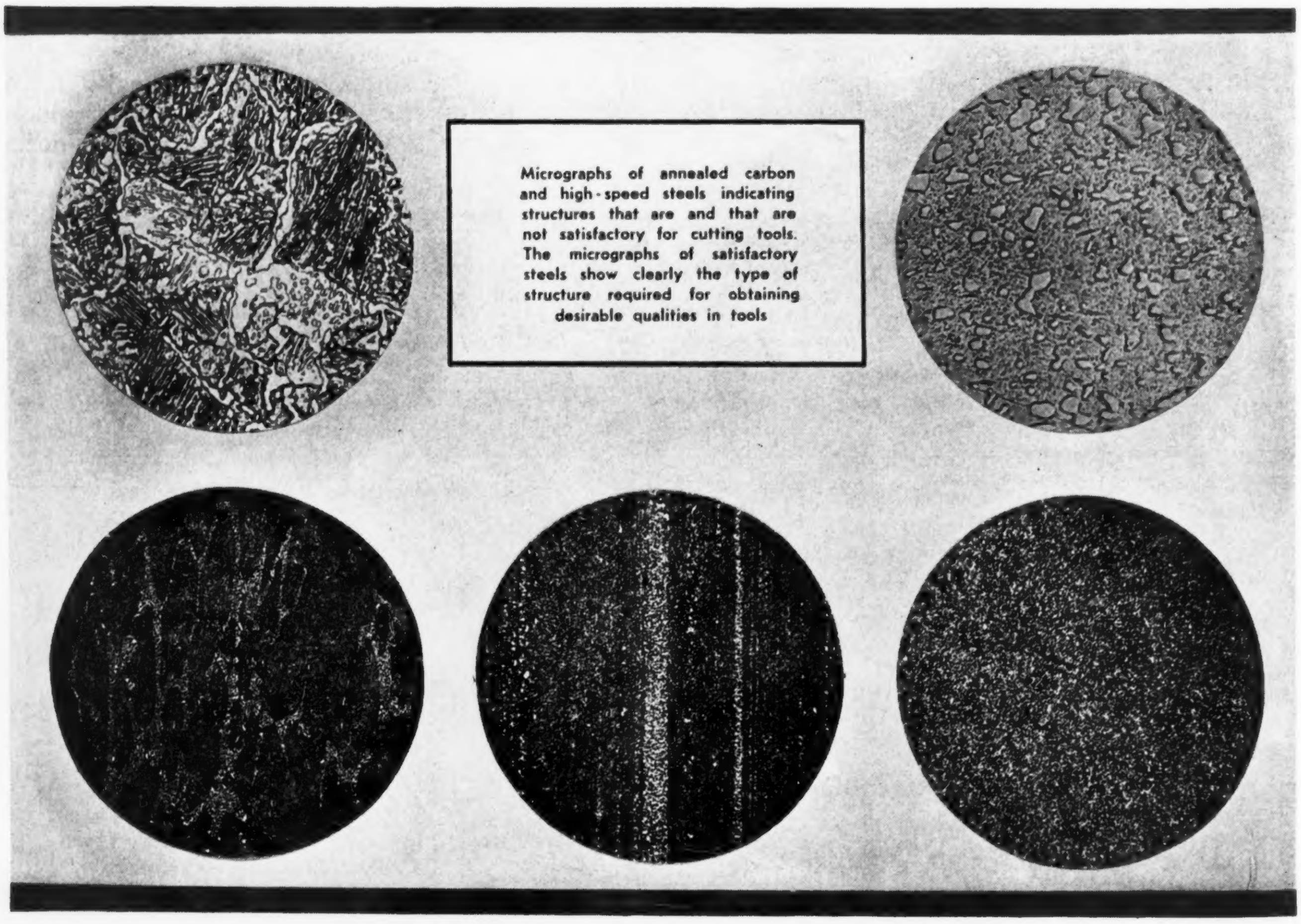


grades of carbides of varying compositions and hardnesses, with full information as to the selection, depending on the machining operation and type of material fabricated. These various grades of cemented carbides range in Rockwell A hardness from 87 to 92.5, the transverse rupture strength running from 130,000 to 250,000 pounds per square inch. Properly hardened and drawn 18-4-1 high-speed steel has a transverse strength of approximately 450,000 pounds per square inch, and a Rockwell A hardness of 82 to 83.

The tungsten carbides are recommended for machining non-metallic materials, non-ferrous metals, and cast iron. The softer grades, having as high as 14 per cent cobalt, are used especially for heavy cuts and roughing work, principally on non-ferrous metals and cast iron; they stand up fairly satisfactorily on interrupted cuts. The soft grades of tungsten carbide also are widely used for wire-drawing dies with excellent results. The harder and more brittle tungsten carbides, having as low as 3 per cent cobalt, are employed on non-metallic materials, and on non-ferrous metals and irons where high speeds and light cuts are used.

One manufacturer markets a tungsten-tantalum-carbide mix as well as a tungsten-titanium carbide material in different hardnesses for use on steel turning, facing, and boring jobs. Another prominent carbide manufacturer has specialized on cemented tantalum carbide, featuring three classifications. Of these, the material lowest in tantalum carbide is recommended for use on non-metallic materials, non-ferrous alloys, cast iron, and chilled iron. The carbide having a medium tantalum carbide content is suggested for machining materials with a longer chip which ordinarily results in cratering; such materials as copper-silicon castings, malleable iron, cast steel, and corrosion-resistant cast chromium alloys come under this classification. The third type, high in tantalum carbide, is recommended for the turning, boring and facing of low and medium carbon steel forgings; alloy steels con-

Fig. 2. (Upper Left Hand) Micrograph of Annealed Carbon Tool Steel Showing Structure of Lamellar Pearlite with Cementite Networks. Brinell Hardness, 197. Not Satisfactory for Cutting Tools. Fig. 3. (Upper Right Hand) Micrograph of Annealed Carbon Steel Showing Well Spheroidized Structure. Brinell Hardness, 179. Satisfactory for Machining and Hardening. Proper Structure for Cutting Tools. Fig. 4. (Lower Left Hand) Micrograph of Annealed High-speed Steel Showing Badly Segregated Structure. Not Satisfactory for Tools. Fig. 5. (Lower Center) Micrograph of Annealed High-speed Steel Showing Carbide Segregations. This Steel is not Satisfactory for Cutting Tools. Fig. 6. (Lower Right Hand) Properly Hammered and Annealed High-speed Steel. Note Uniform Distribution of Carbides and Tungstides. Satisfactory for Cutting Tools. Figs. 2 and 3, Magnification, 1000 Diameters; Figs. 4 to 6, 100 Diameters



Micrographs of annealed carbon and high-speed steels indicating structures that are and that are not satisfactory for cutting tools. The micrographs of satisfactory steels show clearly the type of structure required for obtaining desirable qualities in tools

taining nickel, chrome, vanadium, and molybdenum; and stainless steels. The steel-cutting type possesses a high resistance to cratering, so necessary where steel is being machined.

The three classifications of tantalum carbide also have several grades, each possessing a different hardness. The softest grade in the first group has a Rockwell A hardness of 88.5, the transverse rupture strength being given as 300,000 pounds per square inch. Two principal grades are found in the third or steel-cutting group: The harder of these two grades (Rockwell A 92) is used for the general machining of steel; the softer has a Rockwell A hardness of 90.5 and will work on some intermittent steel-cutting jobs, being widely used for the intermittent cutting of alloy cast irons containing copper or nickel.

The Grinding of Carbide Tools

Grinding wheel manufacturers have developed special wheels for grinding the extremely hard cemented carbides, the diamond wheel being widely used today with excellent results. Dry grinding is recommended for free-hand grinding, except when using lapping disks or diamond wheels. When finishing with the lapping disk or diamond wheel and when machine grinding, where the work is held in a fixture or vise, wet grinding is recommended. Grinding marks may cause early failure of the carbide tip, so the extra cost of lapping after grinding is a good investment. The use of 220- and 300-grain diamond wheels results in a surface free from all grinding marks. One user of carbide tools has made a device that simplifies the grinding of carbide turning tools. This consists of a grinding fixture that reduces the hazard of cracking by permitting the tool to move away when it encounters too much resistance, usually due to uneven wheel wear. The rebound encountered in the usual fixture does not occur when this device is employed.

In machining with carbide tools, the carbide manufacturers recommend the use of a coolant or cutting fluid only on operations where the heat generated will distort the part or result in sufficient temperature to affect the braze.

The improvement in the quality of cemented carbides and the introduction of new grades, increased knowledge as to correct tool design, availability of rugged machine tools capable of being operated under the high speeds demanded of this material, and the marked reduction in price of the carbides all have contributed to the greatly increased use of this cutting material, especially for the simpler machining operations such as turning, facing, and boring. As the art advances, undoubtedly we will see an increased demand for carbide-tipped reamers, counterbores, cutters, and similar tools. There always will be a large demand for high-speed steel tools, however, regardless of advances made in the developments of new cutting materials. The value of cemented carbide sales in 1936 greatly exceeded that of any previous year. This statement is also true of high-speed steel sales.

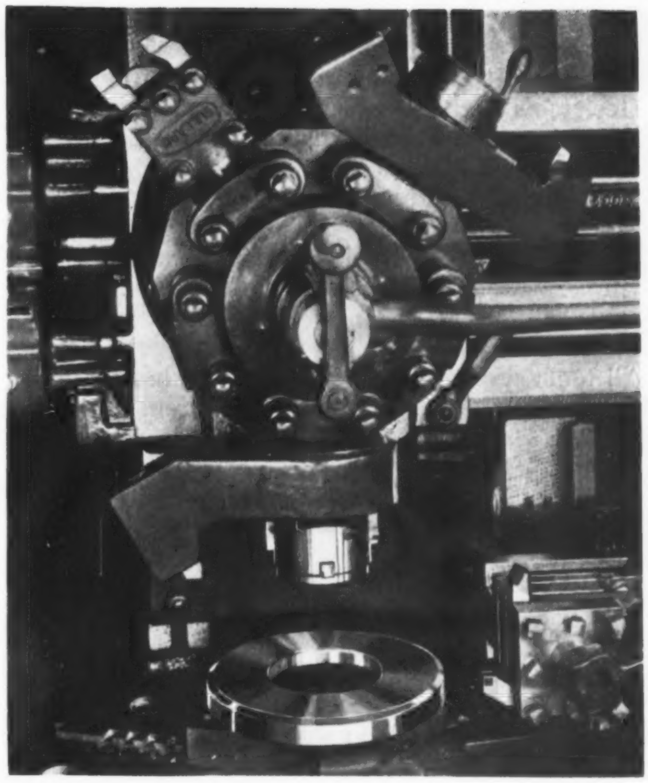


Fig. 7. Tungsten-carbide Tipped Tools Boring, Facing, Turning, and Reaming Bronze Worm-gear Blanks. Floor-to-floor Time, 3 Minutes 42 Seconds

Turning, facing, and boring tools, as well as milling cutters made of Stellite J-metal, a non-machineable cast alloy of cobalt, chromium, and tungsten, are commonly employed today for machining non-ferrous, as well as ferrous, materials. These Stellite tools (solid in the smaller sizes and with welded tips in the larger sizes) possess a very high degree of red hardness. They can therefore be operated at speeds and feeds considerably higher than those employed for high-speed steel. Stellite is file-hard, but the Rockwell C reading is only 55-57. Possibly a "splitting" action takes place when the diamond penetrator is applied, using a 150-kilogram load, thus giving a false reading.

Recently a new Stellite composition known as "2400" has been introduced. It is stated that tools made of this material can be operated at higher speeds and feeds than J-metal; they also stand up considerably longer between grinds. Stellite cutting tools have a definite place in metal-working plants, being economically employed on many production jobs.

The Hardening of Cutting Tools

Progressive manufacturers of cutting tools, realizing the importance of properly hardening carbon, alloy, and high-speed steel tools, have spared no expense in connection with the installation of modern and efficient hardening room equipment; and the manufacturers of hardening room equipment

have greatly improved the design of their furnaces, quenching baths, automatic temperature controllers, etc. It is common practice to harden carbon steel tools such as taps, dies, drills, reamers, etc., in lead or salt bath furnaces provided with automatic temperature control. Considering the importance of the time in the heating bath, electric timers should be employed.

Carbon steel tools usually are quenched from a temperature of 1440 to 1460 degrees F. in a strong brine solution maintained at a temperature of from 65 to 70 degrees F. through proper refrigeration. All tools should be drawn after the hardening operation, the temperature varying from 250 to 650 degrees F., depending on the type of tool and its use.

High-speed steel cutting tools made from 18-4-1 steel should be preheated at from 1500 to 1600 degrees F., and then placed in the high-temperature chamber at a temperature ranging from 2300 to 2360 degrees F. Where oil- or gas-fired high-speed steel furnaces are employed, the tools should be transferred to the quenching bath as soon as they reach the furnace temperature. In the case of electrically heated furnaces, such as the Globar type, soaking the tools at the furnace temperature for a short interval does not result in grain coarsening.

All high-speed steel tools should be drawn, the temperatures usually running from 1050 to 1200 degrees F., depending principally on the type of tool. The tools should remain at the drawing temperature for approximately two hours, and then be air-cooled. The high "draw" has very little effect on the hardness of the tools until a temperature of 1100 degrees F. is reached. This tempering treatment results in a high degree of toughness and minimizes the danger of grinding cracks. The Rockwell hardness test, supplemented by special temper testing files, is the proper means of checking the hardness of the finished tools, whether made from carbon or high-speed steel.

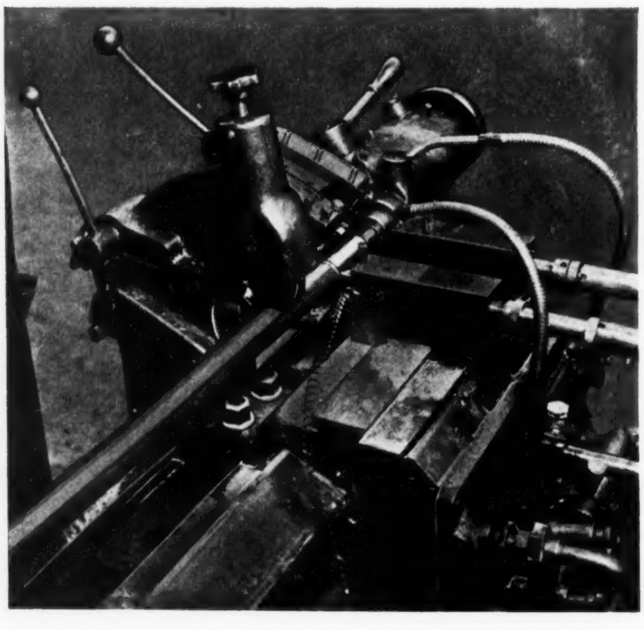


Fig. 8. Tantalum-carbide Tool Turning Alloy-steel Propeller Shaft. Brinell Hardness, 302 to 340; Cutting Speed, 123 Feet per Minute; Pieces per Grind, 600 to 800

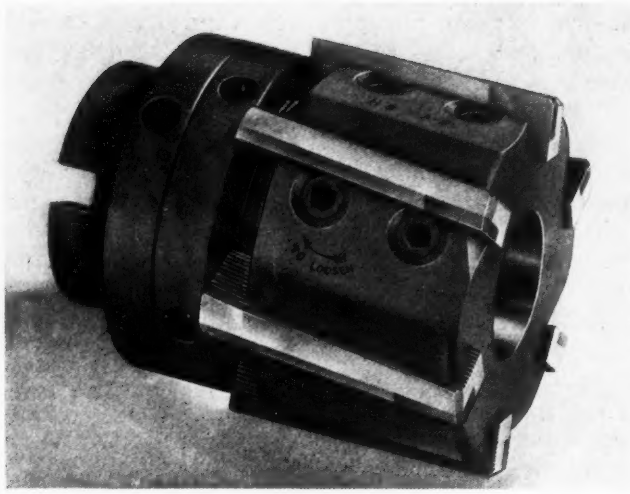


Fig. 9. A Cam-lock Serrated-blade Reamer Having Tungsten-carbide Blades

Cobalt high-speed steels require a hardening temperature of 2400 degrees F., the same heat being recommended for tools made of the 18-4-2 type. Molybdenum-tungsten high-speed steel tools are hardened at a temperature of approximately 2200 degrees F. These special steels all respond to the high drawing treatment in a manner similar to the 18-4-1 type.

When Cutting Tools May be Nitrided

Certain types of cutting tools properly nitrided after the finish-grinding operation perform in a more satisfactory manner than tools not so treated. These nitrided cutting tools work most efficiently on plastics, some of the non-ferrous alloys, and certain types of cast iron. The nitrided case usually is only a few ten-thousandths inch deep, but due to its extreme hardness, at times it chips or flakes, especially on tools with threads used on steel jobs. Considerable judgment must be used in regard to the application of nitriding to precision cutting tools, the type of tool, material being machined, and general operating conditions all being important factors worthy of careful consideration.

Very few cutting tools today are chromium-plated, as tests have indicated that there is quite a limited field for tools so treated. Reamers used on some of the softer metals give a somewhat longer life when properly plated, the reamers being ground to size after the plating operation, thus leaving the plate only in the flutes. Chromium-plated taps usually fail, due to chipping. The occluded hydrogen absorbed during the plating operation results in marked brittleness. Milling cutters and hobs are not benefitted by having a flash plate of chromium. Experience also has shown that it is not economical to salvage worn cutting tools by chromium-plating them to size.

Many industrial plants have established special departments for the regrinding of drills, reamers,

cutters, hobs, taps, dies, etc., experienced grinding machine operators taking care of this most important work. An executive of a large middle western plant recently stated that his company effected a saving of many thousands of dollars yearly in cutting tool costs as a result of the proper regrinding of tools by experienced men whose sole duty it was to do this work, using the most efficient grinding equipment available. An eastern manufacturer has shown a saving of 30 per cent in his expenditures for twist drills, 25 per cent for milling cutters, and 50 per cent for reamers during 1936, as compared with 1928, due both to the improvement in the quality of cutting tools during this period and to his present practice of having all cutting tools reground by experienced operators. These figures were based on the company's total shipments and the value of the cutting tools consumed during each of these years. As this company spends several hundred-thousand dollars yearly for cutting tools, these savings are most important.

A large manufacturer of grinding wheels says that the value of tools ruined by improper grinding closely approaches that of tools lost in hardening. One has only to observe expensive cutting tools being reground with improper wheels or without proper coolant, resulting in burning of cutting edges, grinding cracks, etc., to appreciate the truth of this statement. Many tools requiring special grinding machines and fixtures for proper resharpening are hand-ground, with a resultant loss in cutting efficiency and accuracy of the machined parts. Tools as supplied by the manufacturer, with correct rake angles, clearances, etc., when reground by the user do not give proper performance unless similarly ground. The importance of properly regrinding cutting tools cannot be over-emphasized.

Importance of the Right Cutting Lubricants

Cutting fluids or cutting oils have an important effect on tool life, quality of finish, and accuracy of machined surfaces. Soluble oils and compounds, sulphur-base oils, paraffine oil, white lead and oil, lard oil, and kerosene all have their definite fields, and when properly employed, result in maximum tool life and satisfactory finish. Sulphur-base oils are widely used with excellent results on many machining operations. Soluble oils and compounds also have a large field. Kerosene, with or without a small amount of lard oil, is commonly used in the machining of aluminum and magnesium alloys. A chemical added to the kerosene minimizes the danger of skin infection.

A good flow of the cutting fluid, properly directed, is essential, or else early tool failure will result. Many reported tool failures and rejection of work because of poor finish have been traced directly to the use of the wrong type of cutting oil or improper flow of the fluid. Metal-working plants have profited by making a study of their cutting oil requirements, adopting, at the most, only three to four different cutting fluids to take care of all machining operations.

The more expensive cutting oils frequently prove to be the most economical, based on increased tool life and less scrap loss. One plant more than doubled the number of pieces per grind obtained from their milling cutters by changing from a soluble oil to a sulphur-base cutting oil. Another company that suffered heavy rejections on parts made from properly annealed high-speed steel, due to rough finish, solved its problem by using the correct grade of sulphur-base oil, no other change being necessary. These cases are only two of a large number brought to the writer's attention, demonstrating the importance of proper cutting oil selection.

Another factor governing tool life, finish, and accuracy of machined parts is the grain size of the various types of steels fabricated. The coarser grained steels machine more readily than the finer grained materials, with marked improvement in production, due to less "down" time of the machine as a result of longer tool life between grinds. An excellent finish usually is obtained where the coarse-grained steels are employed, as the chips from the more brittle material break readily, compared with the tearing and dragging action in the case of the tougher, fine-grained materials. The coarse-grained steels, however, harden deeper than similar steels with a finer grain, resulting in greater hardening distortion, and due to the coarse-grained structure, they are not as tough as the fine-grained steels. It is the practice of some concerns to so anneal their steel before machining as to produce an actual coarse-grained structure, refining the grain size before finish-machining, so as to assure minimum hardening changes and satisfactory physical properties.

The manufacturers of cutting tools stand ready at all times to cooperate with the users as to the selection of the proper type of tool for each operation. The correct usage of tools includes the employment of efficient machine tools, satisfactory tool-holders, proper work support, correct speeds, feeds, and depths of cuts, and the best cutting fluid. Tool costs are materially reduced when the tools are given proper care, especially in connection with regrinding.

* * *

Increase in Shipbuilding Indicates Improved Trade

Considerable improvement in business conditions throughout the world is indicated by the shipbuilding returns of *Lloyd's Register* for the year ending June 30, 1937. The tonnage of ships built in Great Britain and Ireland on that date is 40 per cent greater than the figure for June 30, 1936. A similar increase has taken place in other countries throughout the world. Following Great Britain, the four leading shipbuilding countries are Germany, Japan, the United States, and Holland. The leading builders of marine engines are Great Britain, Germany, Japan, Holland, Sweden, and Italy, in the order mentioned.

Engineering News Flashes

The World Over

Paint that Resists Temperature of 3000 Degrees F.

A paint known by the trade name "Lucifer" has been placed on the market by K. Bader, Westmoreland Road, London, N.W. 9, England. This paint, it is claimed, will withstand temperatures of more than 3000 degrees F. without undergoing any change and without losing its color. It is suitable for protecting any surfaces that are exposed to high temperatures, provided, of course, that the materials to be coated are themselves capable of withstanding the high temperature. The paint forms a hard abrasion-resisting surface that will not chip off. It is stated that it is now being used for the protection of firebricks in furnaces and of other fireclay articles, in which it seals cracks. Owing to the smoothness of the resulting surfaces, it prevents the collection of soot and ashes on the brick surfaces of the furnace.

Unusual Case of Long Tool Life

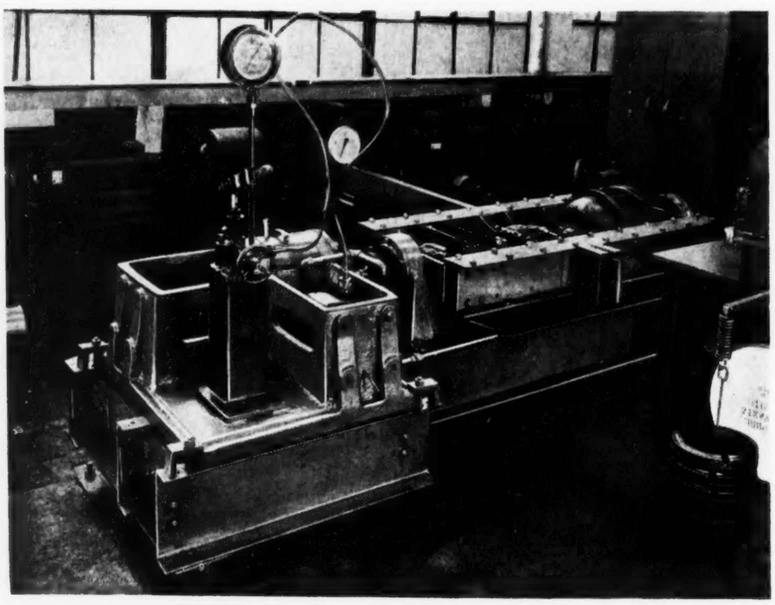
On a large boring mill in the Schenectady plant of the General Electric Co., a cutting tool has been in operation for seven years, turning the outside of motor and generator commutators. During this time, it has turned more than 800 commutators, involving the cutting of 4400 miles of copper and mica alternately. The tool is tipped with Carboloy. It has been dressed from time to time, but it is estimated that it has still one-half of its useful life left. The roughing cut is taken at a speed of 400 feet per minute, with a 1/32 inch feed. The depth of the roughing cut is approximately 1/8 inch. The finishing cut is taken at the same speed as the roughing cut, but with a feed and depth of cut of 0.015 inch.

New Type Motorcycle Engine

News comes from Great Britain that F. M. Aspin, a young engineer of Bury, Lancashire, has developed a single-cylinder motorcycle engine, which, in tests, has run 2000 miles on regular roads at speeds up to 75 miles an hour, averaging 150 miles to the gallon of gasoline.

Noise in Steel Mills Reduced by Anti-Friction Bearings

Noise abatement in the steel mill would appear to be a rather futile objective, but that is exactly what has been accomplished in the new continuous rod mills of the American Steel & Wire Co., United States Steel Corporation subsidiary, recently opened in Cleveland, Ohio. Noise measurements made there by sound engineers disclosed an average noise level about equal to that of heavy street traffic, or the equivalent of an ordinary domestic vacuum cleaner at a distance of about 2 feet. Anti-friction bearings installed in the rolling equipment of these new mills in order to assure a more accurate pro-



A Roller Bearing Testing Machine Installed in the Laboratory of the Timken Roller Bearing Co., Having a Capacity for 12-inch Outside Diameter Bearings, by Means of which Both Radial and Thrust Loads of 150,000 Pounds can be Applied to the Bearings

duct are responsible for the reduction in noise. Visitors to steel mills have always found it necessary to shout at the top of their voices to carry on a conversation, but in these new mills, one can talk in almost a normal tone.

Hatfield Announces New Type of Steel

Dr. W. H. Hatfield of Sheffield, England, has announced the development of a steel known as "Stayblade Max" which resists oxidation in air and steam up to temperatures as high as 1650 degrees F. The steel is said to be easily machineable, and is intended for boiler drums, turbine casings, high-temperature reaction vessels, and other plant units which operate at high temperatures under great stresses. It is also being tried for blades in high-temperature turbines. The steel contains high percentages of chromium and nickel, as well as titanium and aluminum.

Improved Tungsten Filament Lamp

It is announced by the General Electric Co.'s incandescent lamp department at Nela Park, Cleveland, that a new high-efficiency tungsten filament has been developed which will increase the light output of lamps 10 per cent without using any additional electric current. This development is declared by engineers to be one of the greatest forward steps in tungsten filament lamps since the invention of the gas-filled bulb in 1913. This new filament is the result of twenty-four years of continuous research in the lamp development laboratories.

First drawn into a straight wire 0.0019 inch in diameter, so fine as to be almost invisible to the naked eye, the tungsten is then wound 335 turns to the inch around a fine molybdenum wire or mandrel, leaving the coils or turns 0.001 inch apart. The coils must be kept as close together as possible to reduce the heat loss, but must not touch each other, as that would cause a short circuit which would result in instant failure of the lamp.

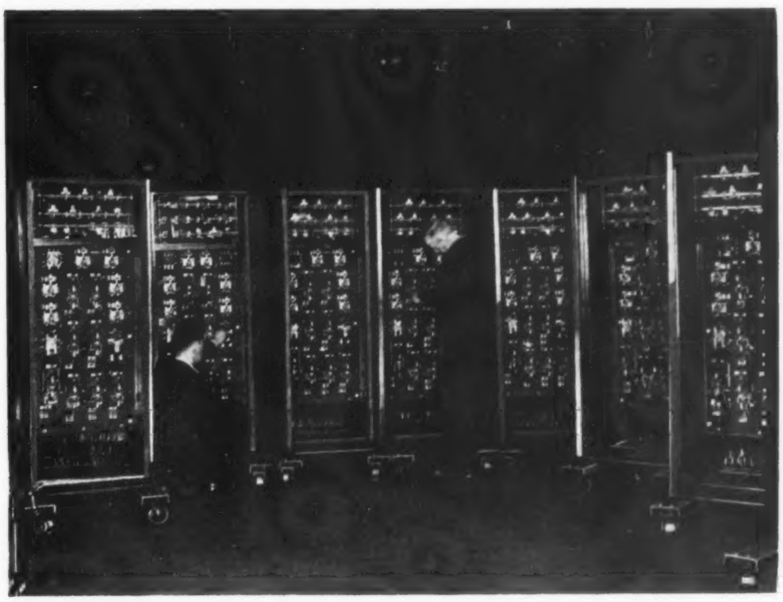
Then the coiled wire is wound on another mandrel 70 turns per inch, with a spacing of 0.007 inch between the secondary coils. Before the first coiling, the wire in the filament is 20 inches long. The first coiling compresses it to a length of 3.4 inches, and the second coiling to a length of 5/8 inch. Following the second coiling, the mandrels or center wires are dissolved by chemicals. Since the effective length of the new filament is only about one-half that of the old, there is much less cooling by the gas in the bulb, which permits the lamp to give 10 per cent more light for the same amount of electric current.

Bicycle Production Exceeds Peak of "Bicycle Age"

It will be a surprise to many to learn that bicycle production last year exceeded that of any previous year, including the former peak year during the bicycle era—1899. In that year, American factories turned out 1,100,000 bicycles, but in 1936, the number rose to 1,250,000.

An Unusual Bronze Welding Repair Job

In a large cement plant, a 400-horsepower motor base was fractured to such an extent that there was a total of 178 linear inches of cracks in it. Thorough preheating and careful lining up and beveling of each crack preceded the welding. One crack, 3 1/2 feet long, was welded from both sides. In order to maintain alignment, a 10-inch channel iron, 12 feet long, was bolted on each side of the casting to support it while welding. It was necessary to turn the casting over six times during the operation.



These New Westinghouse Planer Controllers, in Conjunction with New Planer Motors, will Replace Obsolete Electrical Drives on Planers in a Large Connecticut Plant. They will Permit Higher Return Speeds, Quicker Reversals, and Safer Operation

EDITORIAL COMMENT

Emphasis has frequently been placed on the value of improved production machinery in making possible a higher standard of living. The part that invention plays in improving the standard of living has not been so often referred to. Yet, before improved machinery can be used for the manufacture of articles and devices that add to the convenience and comfort of life, somebody must have conceived of these new appliances—that is, somebody must have invented them.

Highly developed production machinery is now used in building automobiles, but somebody had first to invent a practicable small, high-powered engine; otherwise there would have been no automobiles. The same is true of the thousand and one appliances that make life today more comfortable, convenient, and interesting—the telephone, the radio, the sewing machine, the vacuum sweeper, the electric toaster, the typewriter, the adding machine, and the many other modern developments.

After All, It is the Inventor who Starts the Ball Rolling

Let us not forget to give credit to the inventor. He is at the very beginning of the production line. He is the one that has lessened the toil of mankind, provided more leisure hours, secured for millions more congenial employment, and created more variety and interest in life.

Where Workers Have Profited by Improved Machinery

Interesting evidence, showing how improved machine equipment aids in raising the standard of living and improving working conditions, instead of causing unemployment and distress, is presented by Naboth Hedin in a recent magazine article "Why Sweden Leads in Recovery." Mr. Hedin points out that in the last ten years, production costs in several machine industries in Sweden have been reduced anywhere from 50 up to 86 per cent. In some of the Swedish pulp mills, which produced annually 54 tons of pulp per worker in 1920, the 1934 output was 124 tons. These increases in output and reductions in cost were obtained through the use of new and improved machinery.

According to the theories that have been advanced in this country by government officials and labor leaders alike, such production increases brought about by machinery should have produced dire results for the workers in Sweden. What are the facts? At the present time, there is practically no unemployment in that country. The year 1929 is no longer looked on as the most prosperous year on record; 1936 was a far better year. Taking 1915 as 100, the production in Sweden in 1929 rose to 147, but by now these figures have been greatly exceeded.

What has happened to wages? Basing the comparison on the buying power of the wages received, we find that from 1913 to 1929, wages rose in purchasing power 37 per cent. There was a slight dip in 1932 and 1933, but now the rise is up to 45 per cent. In actual dollars and cents, the rise is much greater than this, since, of course, prices have increased since 1913; but the real test is that present wages buy 45 per cent more of the necessities and comforts of life than they did some twenty-five years ago. The workers have that much more to spend for goods and services, and this, in turn, keeps the factories busy and both foreign and domestic trade active.

The unemployment in the United States is obviously not caused by the use of new and improved machinery. The author of the article quoted states the case accurately when he says, "Sweden has not, as far as I know, found any magic formula, except hard work and a fair distribution of the proceeds."

Purchasing Agent's Chance to Create Good Will

On several occasions in the past, attention has been called in MACHINERY to firms who have adopted definite policies to prevent keeping salesmen waiting unnecessarily. The man who does the buying for a firm, whether he be known as purchasing agent or by some other title, has an unusual opportunity for creating good will for his company. The consideration that he shows salesmen can be made to pay dividends. Salesmen have a large circle of friends, and what they say about a firm is publicity not to be overlooked. Suppose a hundred salesmen go about praising a firm and boosting its products because they have received courteous treatment by that firm's purchasing department—isn't good advertising like that worth a friendly reception?

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

Selective Timing Mechanism for Actuating a Control Lever

By DONALD S. WARNER

The timing mechanism shown in Figs. 1 and 2 was designed by the writer and is being used successfully on one of the textile machines manufactured by the James Hunter Machine Co., North Adams, Mass. As shown in the illustrations, it differs from the conventional type of timing devices. It covers a wide range of timing requirements and can be set for such operating intervals or periods as 1, 2, 3, 4, and 5 minutes, or 8, 16, 24, 32, and 40 minutes. An important feature of this mechanism is its extreme simplicity, the selection of the various intervals or time periods being instantly accomplished by merely turning a knob. This eliminates the necessity for locating or relocating various fingers or cam lobes about a disk, as in the conventional type of timing devices.

The specific purpose of the mechanism illustrated is to impart one forward movement to lever *V*, Fig. 1, for a predetermined number of revolutions of shaft *B*. This forward movement of lever *V* can be used to release a clutch, make an electrical contact, or perform any duty necessary for starting other mechanisms or machines at the selected time intervals.

Crank *A* on the drive-shaft *B* transfers a reciprocating movement to the bellcrank *C* through the connecting-rod *D*. Bellcrank *C* is free to turn on stud *E*, and through its pawl *F*, rotates the ratchet wheel *G*. The ratchet wheel *H* rotates in unison with ratchet wheel *G*, as both members are keyed to sleeve *I*, which is free to turn on stud *E* and ex-

Fig. 1. Mechanism with Dial or Control Knob S, which can be Set to Any Number from 1 to 5 to Cause Lever V to Move Forward after Any Number of Revolutions of Shaft B from One to Five

tends through the stationary frame *J*. A helical torsion spring *K*, mounted between ratchet *G* and frame *J*, tends to rotate the two ratchets in an opposite direction to that imparted by bellcrank *C* and pawl *F*. Ratchets *G* and *H* are divided into six equal parts, five of which have teeth that are engaged by pawls *F* and *L*, respectively. Referring to Fig. 2, these teeth are marked No. 1_1, No. 2_1, No. 3_1, No. 4_1 and No. 5_1.

Pawl *F* is released from ratchet *G* at the end of its stroke by cam *M*, but the ratchets are normally prevented from rotating under the action of spring *K* by pawl *L* mounted on frame *J*. Lever *N*, the function of which is to lift pawl *L* from ratchet *H*, is prevented from rotating too freely on stud *E* by the friction block *O* and spring *P*, and is carried forward under pawl *L* by the cam lobe *Q* on ratchet *H*, and backward by pin *R* in control knob *S*. Pin *R* can be placed in any one of the holes in ratchet *H*

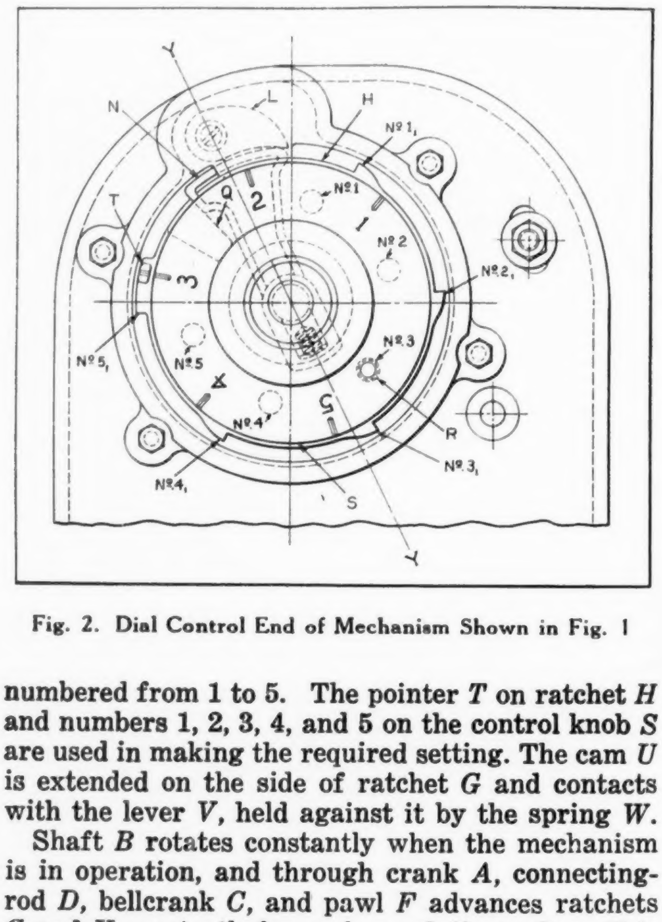


Fig. 2. Dial Control End of Mechanism Shown in Fig. 1

numbered from 1 to 5. The pointer *T* on ratchet *H* and numbers 1, 2, 3, 4, and 5 on the control knob *S* are used in making the required setting. The cam *U* is extended on the side of ratchet *G* and contacts with the lever *V*, held against it by the spring *W*.

Shaft *B* rotates constantly when the mechanism is in operation, and through crank *A*, connecting-rod *D*, bellcrank *C*, and pawl *F* advances ratchets *G* and *H* one tooth for each revolution. Cam *U* is an integral part of ratchet *G* and acts upon lever *V* only when ratchets *G* and *H* are in the position shown. The position of ratchets *G* and *H* at the start of the timing cycle determines the number of revolutions of shaft *B* for each forward movement of lever *V*.

This is accomplished as follows: Assume that pin *R* is placed in hole No. 3, as indicated in Fig. 2. While cam *U* is acting upon lever *V*, the lobe *Q* on ratchet *H* carries lever *N* under pawl *L*, lifting it clear of ratchet *H*. When pawl *F* is released from ratchet *G* by cam *M*, ratchets *G* and *H* turn backward through the action of spring *K*, until pin *R* comes in contact with lever *N* and carries it backward in time to allow pawl *L* to drop and engage tooth No. 3_1. Thus, during the third revolution of shaft *B*, the ratchets and cam *U* again come into position to move lever *V* forward.

Should pin *R* be placed in hole No. 4, lever *N* would be carried back from under pawl *L* by pin *R* one tooth later when the ratchets were returned by spring *K*, and pawl *L* would engage tooth No. 4_1. Lever *V* would then be moved forward during the fourth revolution of shaft *B*. Should pawl *L* fail to engage any of the teeth, spring *K* would be prevented from being unwound by a safety stop, which is just in front of the end of pawl *L* on the vertical center line, Fig. 2. This stop prevents the pointer *T* from making a complete revolution.

Pin *R* is so arranged that it cannot be removed from in front of lever *N*. Therefore, if hole No. 2 is selected, lever *N* will be carried backward during the setting, and after imparting the forward movement to lever *V*, the return of the ratchets will be stopped on tooth No. 2_1. The forward movement of lever *V* will then take place during the second revolution of shaft *B*.

This mechanism can be designed for a different number of timing periods by dividing a cycle of the ratchets into one more division than the number of timing periods desired and proportioning the stroke of the connecting-rod accordingly.

Indexing Mechanisms for Small Film Projector

By PAUL GRODZINSKI

The film indexing mechanism shown in Fig. 1 was designed for a small motion picture projector, the object being to obtain the desired indexing motion with the minimum number of moving parts. The indexing movement imparted to the shoe *H* by the mechanism carries the film from the position indicated at *M* to that indicated at *N*.

The cranks *A* and *B* are mounted on shafts carrying the two spur gears *C* and *D*, which are always in mesh. Gear *D* has four times as many teeth as gear *C*, so that crank *A* makes four revolutions to one revolution of crank *B*. The ends of cranks *A* and *B* are connected to rods *E* and *F*, the free ends of which are united by a third rod *G*. This rod actuates the shoe or lever *H* which swings about the pivot pin *P* when indexing or moving the film from *M* to *N*.

During one revolution of crank *B*, which corresponds to four revolutions of crank *A*, a very complicated curve *Q*, having eight single strokes or four double strokes, is traced by the point *I*. The range of the curve is limited by four circles, the radii of which are equal, respectively, to the lengths of the following members: $F + B$ and $F - B$ drawn around point *J* as a center and $E + A$ and

E — A drawn around point K as a center. For the movement of the film, only the last two single strokes, indicated by the heavy lines at L, are utilized, whereas the other three double strokes are not used. During the time in which the point I traces the lines representing these three double strokes, gear D makes three-fourths of a revolution without transmitting any motion to the film.

Fig. 2 shows a similar driving mechanism developed by the writer, which gives an equivalent indexing movement, but avoids the idle time period. This mechanism rests at first for three-fourths of a revolution of the driving shaft S. For this purpose, a Geneva stop motion with four stops and one roller is used. During one-fourth of the rotation of the driven member D, the point K of the mechanism is required to make a double stroke. Therefore, between the driving member B of the Geneva stop motion and crank A of the mechanism there must be a ratio of 4 to 1. Also, the index dial of the Geneva stop drive should be provided with a large gear D, whereas the crank R should have a small gear C which is one-fourth the size of gear D.

During the indexing motion, the crank A makes one full turn or rotation. This rotational movement is then changed by a four-bar-link motion involving the members A, E, F, and a fixed member, causing them to give a swinging motion to the point K. Point K follows the path indicated by lines W if the connecting lines from the point K through the free links L and T pass through the respective fixed axles R and U of the mechanism.

For the sake of simplicity, the fixed axle U of the four-bar-link was selected as the fixed axle of the index dial. With the position of the curve

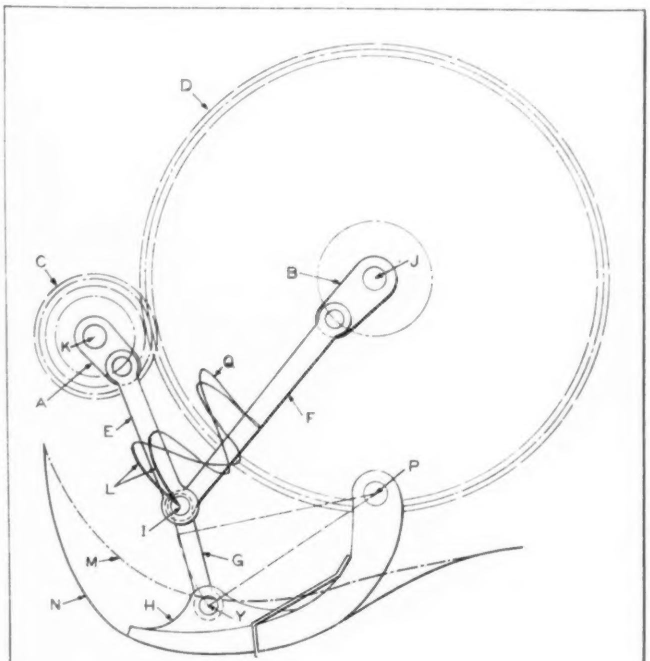


Fig. 1. Double-crank Link and Gear Mechanism for Indexing Motion Picture Film

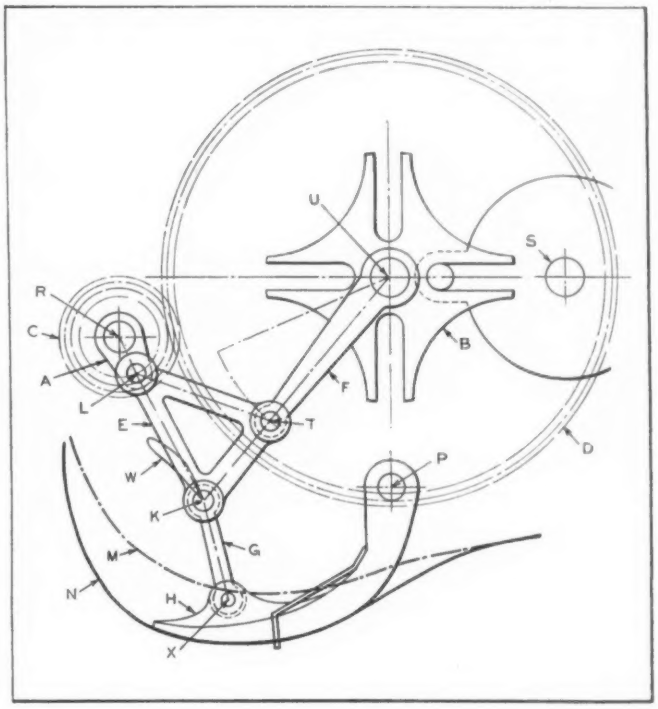


Fig. 2. Geneva Stop Motion Link and Gear Mechanism for Indexing Motion Picture Film

point thus fixed, the mechanism can be laid out or drawn. If the lengths of crank A and the swinging lever F are so proportioned that crank A can make a full rotation, the point X will follow a path similar to that of point Y, Fig. 1.

* * *

Unemployment—A New Approach

A booklet entitled "What Can Industry Do About Unemployment?" has been published by N. W. Pickering, president of the Farrel-Birmingham Co., Inc., Ansonia, Conn., in collaboration with Allen W. Rucker. This booklet is a thorough study of employment in existing industries. It indicates that additional employment has always been provided mainly by new manufacturing plants and industries, since the older plants, on an average, continue to employ about the same number of people.

The study also points out that an adequate standard of living for the entire population of the United States requires a production that would have to be supplied either by additional industrial work involving some 5,000,000,000 man-hours, or an increase of 54 per cent in the productivity of each worker per hour. Unless more goods are produced, it is pointed out, no possible increase in dollar wages will raise the real standard of living; nor will that part of the population that at present does not enjoy what we term the American standard of living, have any chance to improve their living standard. More goods and more work—not shorter hours, less work and less production—is the solution of the problem of well being in these United States.

Practice in Machining Zinc-Alloy Die-Castings

Directions for Machining Die-Castings, Compiled by the New Jersey Zinc Co. on the Basis of Information Obtained from a Great Number of Plants where Die-Castings are Produced and Machined, and from Makers of the Required Tools and Equipment—Second of Six Articles

IN the first installment of this series of articles, published in October MACHINERY, page 92, the drilling of zinc-alloy die-castings was dealt with. The present article discusses the tapping and threading of die-castings.

Zinc alloys are readily tapped with standard tools—so readily, in fact, that in the case of small holes, it is nearly always cheaper to tap than to cast the thread around a core, which subsequently has to be unscrewed. Holes for tapping are often cored in the casting, and, when this is done, drilling or reaming prior to tapping may not be necessary. It should be remembered, however, that core-pins require some taper; hence cored holes are smaller at the bottom than at the top, and the deeper the holes, the greater is the difference in size. Unless due allowance is made for this fact, or the hole is reamed or drilled before tapping, tap breakage may occur, especially in deep or blind holes, or a poor thread may result.

For best results in tapping, other precautions are desirable to reduce difficulties and to speed production. These have to do with the selection and grinding of the taps. The taps are nearly always of standard type, and even the grinding need not be special in many cases. Although it is by no means essential to use ground-thread taps, these are often employed, especially in sizes above 1/4 inch, as they produce a smoother thread surface, free from the galling sometimes encountered with unground taps. Some contend that the added cost of ground taps is much more than offset by the greatly increased life of the tap, as compared with the unground variety; but one die-caster states that no economy results from using ground taps, although he uses them extensively where close limits must be maintained. Another shop uses ground taps for blind holes only. However, unground taps produce satisfactory threads for many purposes; but where close limits must be maintained, the ground tap gives better results.

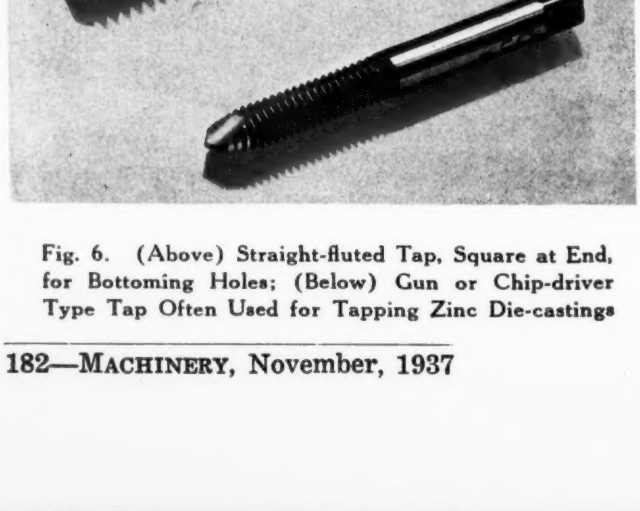


Fig. 6. (Above) Straight-fluted Tap, Square at End, for Bottoming Holes; (Below) Gun or Chip-driver Type Tap Often Used for Tapping Zinc Die-castings

As with drills and other tools, plenty of chip clearance is desirable in taps, and they should be of such a design as to provide clearance and, as far as possible, should feed the chips away from the cutting edge. Two-fluted taps are commonly preferred for holes up to about 3/8 inch in diameter, and one less flute than standard in other sizes also. On sizes below 1/4 inch, however, three-fluted taps, according to one large user, have longer life than two-fluted ones, because, although the three-fluted type is weaker, the extra flute tends to reduce friction and thus to decrease breakage and prolong the average tap life.

Since zinc alloys are relatively soft and quite ductile, the tap apparently produces something of a spinning effect, causing the metal to flow a small amount and fill in the root of the thread of the tap, so that the tapped hole becomes considerably smaller than before tapping. This action is more pronounced in proportion to thread depth with finer threads. On this account, the hole to be tapped should usually be drilled or cored slightly larger than in cast iron and harder metals. Thus, if the hole before tapping is such as would yield a 65 per cent thread in harder metals, the tapped hole in zinc alloy will be found, as a rule, to have from 85

to 90 per cent of a full thread. This fact should always be borne in mind in preparing the hole for tapping.

Selecting Taps for Through Holes

In the selection of the type of tap, the nature of the hole is an important, if not the determining, consideration. For through holes, especially when they are not very deep, there is much to be said in favor of the type of tap shown in the lower view of Fig. 6, variously called "gun," "chip driver," and "spiral point"; this type is often highly recommended. It has a pointed end or "shear," and the flutes at this end, instead of being straight, are run off at an angle. This results in shearing the metal and curling the chips, which are forced ahead of the tap. Since the chips are kept out of the flutes, the latter can be shallower than otherwise, and this strengthens the tap, thus decreasing the chance of breakage, especially in small two-fluted taps up to about 5/16 inch in diameter.

Although this form of tap can be used for blind holes *if there is plenty of space left in the bottom of the hole for chips,* the latter are sometimes difficult to remove; hence this type of tap is usually not advocated for blind holes. As the lands are quite wide in taps of this kind, there may be considerable friction; consequently, this tap is considered best for holes threaded to a depth of not more than two diameters. Sizes above 5/16 inch usually have three flutes. Spiral-point taps cut rapidly, but are more difficult to sharpen than those in which the flute is straight throughout its length. They generally have five to six threads of lead; the spiral point should always extend beyond the first full thread. One manufacturer recommends regrinding chip-driver taps after each 2000 holes tapped.

Taps Preferred for Blind Holes

For blind holes, and especially for those in which the thread must come as close to the bottom as possible, a straight-fluted tap, square at the end, such as shown in the top view of Fig. 6, with a lead of 1 1/2 to 2 1/2 threads, is generally employed. The flutes should be large enough to give chip clearance, and the lands should be rather narrow so as to minimize friction. Such taps tend to break up the chips. They usually have three flutes for holes under 3/8 inch and four flutes for larger holes. The same tap, but with more of a point and relieved for five or six threads, can be used for blind holes in which the thread does not have to come close to the bottom, or for through holes.

One user reports good results with two-fluted spiral-pointed ground-thread taps on which the lead has been reduced to 1 1/2 or 2 threads for blind holes of 0.164 inch size and smaller. Considerable breakage was experienced on taps of this size without spiral points, because the taps are weakened by the deeper groove required without a spiral point.

Excellent results are secured in some shops with a conventional straight-fluted tap by grinding off the end of the flute at an angle, and under-cutting or putting a slight hook on the adjacent teeth while grinding. If this is done with a very small wheel having its axis parallel to the cut, so that the wheel marks on the latter run circumferentially, there is a better chance that, in tapping, the chips will be curled against the polished surface, and thus loading of the cutting edge may be avoided, as the chips feed out readily.

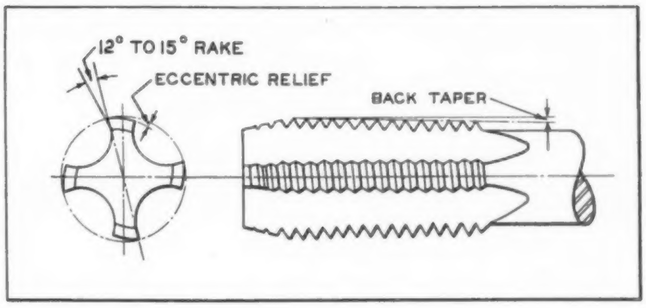


Fig. 7. Tap in which the Lands Have Eccentric Relief or Clearance and the Cutting Edges Have an Appreciable Amount of Rake

Front Rake and Eccentric Relief Facilitate Tapping of Die-Castings

It is generally considered good practice to hook or under-cut the cutting faces of any tap, giving a rake of from 12 to 15 degrees, and on large taps some eccentric relief is sometimes provided, as indicated in Fig. 7. This narrows the land, reducing it, in fact, to a mere line, and thus considerably reduces friction and the chance of galling. Eccentric clearance also facilitates removal of the tap from the hole and prevents it from sticking. With small taps of the ordinary type, sticking can be reduced by grinding off or "breaking" the back corner of conventionally ground lands. One tap manufacturer considers it essential to use relieved taps and states that right-hand steep spiral flutes have proved advantageous, as they tend to carry chips out of the hole.

Any tendency of a tap to pick up metal on the cutting edge interferes, of course, with obtaining a clean cut. This pick-up is not often a serious factor in tapping zinc alloys, but it can be avoided or minimized by keeping the tap sharp and by using a good lubricant. Lubricant helps, too, to reduce breakage and friction, and to improve the finish of the thread, as well as to avoid the "plating" of zinc alloy on the threads of the tap. Such plating changes the dimensions of the tap and increases friction, thereby tending to increase tap breakage. In the case of bottoming holes, at least one shop considers it advantageous to grind the flute so as to have a flat point without hook at the extreme end of the tap.

Most of the foregoing applies primarily to small holes, using solid taps. For large holes, of 1 inch diameter and upward, adjustable or collapsible taps are often used to advantage. The adjustable type

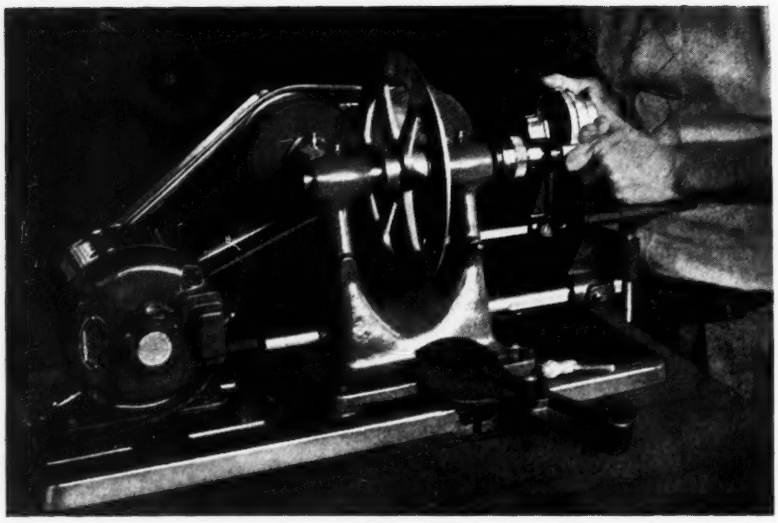


Fig. 8. Horizontal Reversing Bench Tapper with Friction Drive

makes it easy to vary the size and fit of the thread to meet different requirements; the same is true of the collapsible type. In addition, the latter eliminates the need for reversing the tap and any chance of damaging the thread which such reversing may involve.

In selecting taps for tapered pipe threads, the recommendations for bottoming taps should, in general, be followed, some rake and some relief being desirable. One maker especially recommends the use of interrupted-thread pipe taps.

In tapping, as in drilling, there appear to be no very definite rules as to the best cutting speed, beyond the rather obvious one of using the highest speed that will give satisfactory results. Some experimenting may be required to determine this speed for a given set of conditions. High-speed tappers are extensively used, and in some cases, from 2000 to 4000 small holes per hour can be tapped, the number obviously depending upon such factors as the number of holes per piece and the time required to bring the holes into position under the tap.

Tapping Machines and Devices

Good results are secured in many cases with that very simple form of tapper driven by a friction disk between two friction pulleys, giving forward and reverse motions. (See Fig. 8.) This general type of machine is made with either a vertical or a horizontal spindle, and is often used where extreme accuracy is not required and where the work can be guided by hand, although it is readily equipped with inexpensive holding fixtures. Much tapping is done, of course, in drill presses fitted with tapping heads, as well as in vertical-spindle machines designed especially for tapping. Foot-operated tappers and drill presses equipped for foot operation leave the operator's hands free to hold the piece, and this may save time and the expense of clamping fixtures. (See Fig. 9.) Tapping machines with a rigid spindle and chuck have certain advantages; but if the work is held rigidly, the axis of the hole must be brought into correct alignment with the axis of the spindle and tap, as otherwise, the thread will be cut eccentric and tap breakage may result.

Although it is common practice to tap holes for screws and studs, it is entirely feasible to use "self-threading" studs and screws, including drive screws, for certain classes of work, and this sometimes results in production economies that are well worth while.

Many die-castings in zinc alloy require external threads. Although such threads are often cast, they necessitate the use of a die of split section, unless each casting is unscrewed from the die, which is seldom economical. The split die leaves a slight fin at the parting, and this usually requires that the thread be chased. This operation not only removes the fin, but gives a cleaner and smoother, as well as a more accurate, thread than can be cast. In other cases, since chasing is likely to be needed anyway, it is more economical to cast the projecting part to size and cut the full thread.

Threading can be done successfully with button or acorn dies in small sizes, but on large sizes, the

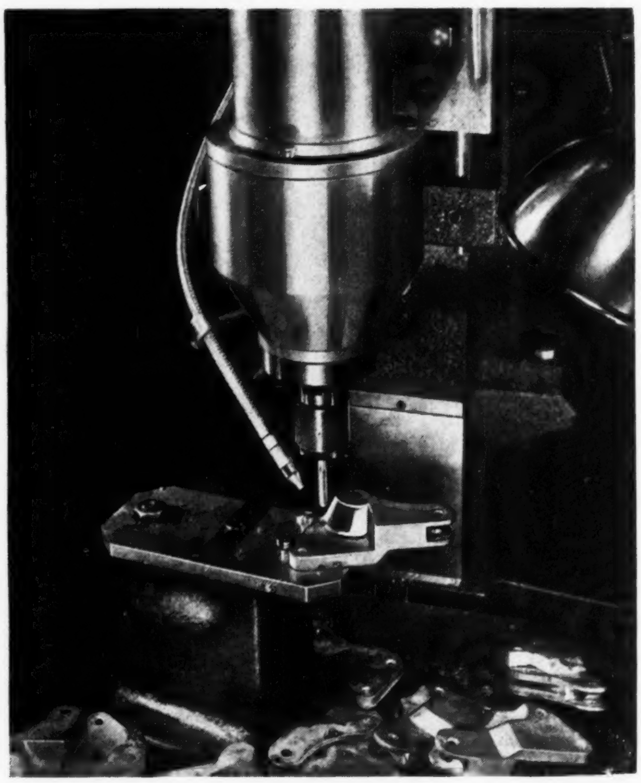


Fig. 9. Inexpensive Swing Fixture Having a Slotted Plate with Two Screws Acting as Hold-down and Stops. Slot Locates Each of the Two Holes. The Irregular-shaped Casting is so Quickly Handled that 980 Pieces are Finished an Hour, Tapping Two 5/16-18 Holes 3/8 Inch Deep in Each. Revolutions per Minute of Tap, "In," 1750; "Out," 3500

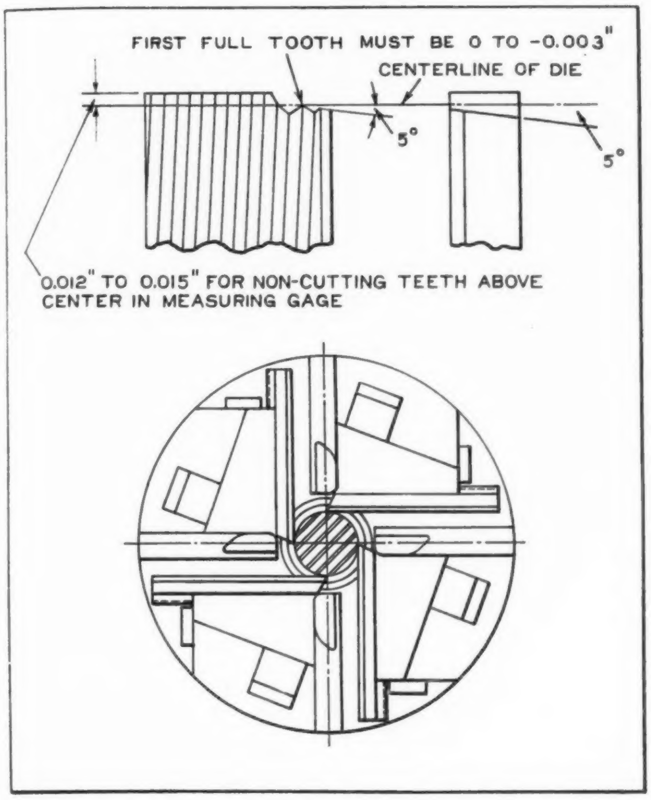


Fig. 10. Die-head with Tangent Chasers Set for Threading Zinc-alloy Die-castings

chaser type of die is recommended. Straight milled chasers are more generally employed, the tapped form, though sometimes used, being less satisfactory for zinc. Chasers may be of either the radial or tangent type. In the case of the radial form, at least one maker recommends a 10-degree radial hook for straight threads and a 7-degree radial hook for tapered threads. The same maker advocates a surface speed of 50 feet per minute for 3 1/2 to 7 1/2 threads per inch; 100 feet per minute for 8 to 11 threads per inch; and 200 feet per minute for 12 to 32 threads per inch.

One maker of tangent type chasers states that, with zinc alloys, the cutting edge of the chaser must be on or very near the center to avoid rapid wearing of the chasers just below the cutting edge, whereas, with other materials, the cutting edge must be above the center. Fig. 10 shows the type of grinding recommended for this type of cutter. It involves a 5-degree rake. With this grinding, some thirty thousand 3/4-inch, 24 threads, are said to have been cut between grinds.

In the case of round dies, one maker recommends a rake of from 15 to 20 degrees, with narrow sections and eccentric relief on cutting sizes of 7/16 inch diameter and larger. Dies, he states, are usually run 10 to 15 per cent slower than taps. Self-opening or solid adjustable dies are recommended for the larger sizes of threads, the former eliminating the need for reversing the die. A projecting type of chaser head using a 45-degree angle and a 7-degree radial hook is considered desirable by one die-caster, when working close to a shoulder.

Improved Furnaces Justify Their Installation

In the January, 1936, number of MACHINERY, page 332, an installation of new furnaces at the Columbia Tool Steel Co.'s plant in Chicago Heights, Ill., was illustrated and described. In this plant, gas furnaces having controlled temperature and controlled atmosphere were then placed in operation. During the comparatively brief period that they have been in use, the new furnaces, which serve 8000-, 3500-, and 750-pound steam forging hammers, have given such satisfaction that the company has now completed an installation of three additional specially designed ingot and billet heating furnaces. These new gas furnaces were installed by the Mahr Mfg. Co., Minneapolis, Minn., who also made the original installation.

It is stated that the installation of these furnaces has caused a reduction in scale, together with better control of surface decarburization, resulting in a greater net return per pound of material handled. In addition, the speed of the heating, added to the accuracy of the temperature control, has improved the quality of the finished work.

The new furnaces embody improvements in the combustion chamber design and in the application of burners and controls that are the result of additional research and of experience gained with the present furnaces. The research has been conducted by Robert G. Guthrie, chief metallurgist of the Peoples Gas Light & Coke Co. of Chicago, and his associate, Dr. Oscar J. Wilbor, who designed the original furnaces.

* * *

Lincoln Electric Co. Erects an All-Welded Building

A new 200,000 square foot factory addition has been erected entirely by welding by the Lincoln Electric Co., adjoining its plant in Cleveland, Ohio. The building was erected in a period of four weeks by the new silent building process of electric welding, without the use of a single riveting hammer. The two-story building employs a new welded rigid-frame sawtooth design with "tree form" columns, recently developed by the Austin Co.'s engineers. There are no cross-members or trusses. These welded tree-form column sections, it is said, would be impracticable with any other method of fabrication because of the high cost. The walls of the building will be made of glass block and sash, thus assuring light of maximum intensity and uniformity.

In all, 1314 tons of steel were used in the construction. A total of 29,600 linear feet of welding, using over 5 1/2 tons of welding electrode, was required. Of the welding, 25,000 feet were completed in the structural shops of the Austin Co., and 4600 feet on the erection site. All the welding was done by the Lincoln Electric Co.'s shielded-arc process.

The Hydraulic Operation of Machine Tools

Valve Designs for Controlling Hydraulic Systems Used for the Operation of Machine Tools—Fifth of a Series of Articles

HYDRAULIC systems for operating various types of machine tools have been described in previous articles of this series. In the present article, several types of hydraulic valve gears for controlling the hydraulic systems are described. The arrangement of a hydraulic rotary valve to which oil is supplied by a gear pump located below the oil level in a machine bed is shown in Fig. 17. The function of the valve is to supply and control the oil delivery to either of the duplex cylinders mounted as shown in the view in the upper right-hand corner of the illustration. These cylinders carry piston-rods which are suitable for two separate feeding motions, as, for example, the sliding and surfacing motions of a lathe.

Pressure oil enters at *C*, and passing through into the bore of the valve, is free, in the position shown, to pass to the left-hand end of the cylinder *A*. At the same time, the exhaust oil coming from the opposite end is free to pass through grooves machined in the valve to the exhaust pipe *D* and the oil reservoir in the bed. A 60-degree movement of the control lever *E* mounted on, say, a lathe apron, changes the position of the valve ports, so that the traverse direction of the piston-rod is reversed. This will be clear from the valve layout at *F*, the positional change being from 180 to 240 degrees; and as the oil duct is gradually closed during this movement, a variable feed can be obtained in either direction.

By rotating the control lever through part of a turn, the oil supply to cylinder *A* is shut off, and the same feeding and reverse motion can be applied to the piston-rod in the cylinder *B* by oil entering and returning through the pipes *G* and *H*.

On many machines, a hand traverse is required, so that it is necessary to provide for a free oil circuit from one end of the cylinder to the other; otherwise, the piston will be locked. In many cases, a separate valve-box is required for this purpose, but the arrangement shown allows this in any intermediate position. Shutting off the oil supply as the lever is rotated will cause pressure to build up in the valve unless provision is made to counteract this, for there is no relief valve on the pump or in the pipe line circuit.

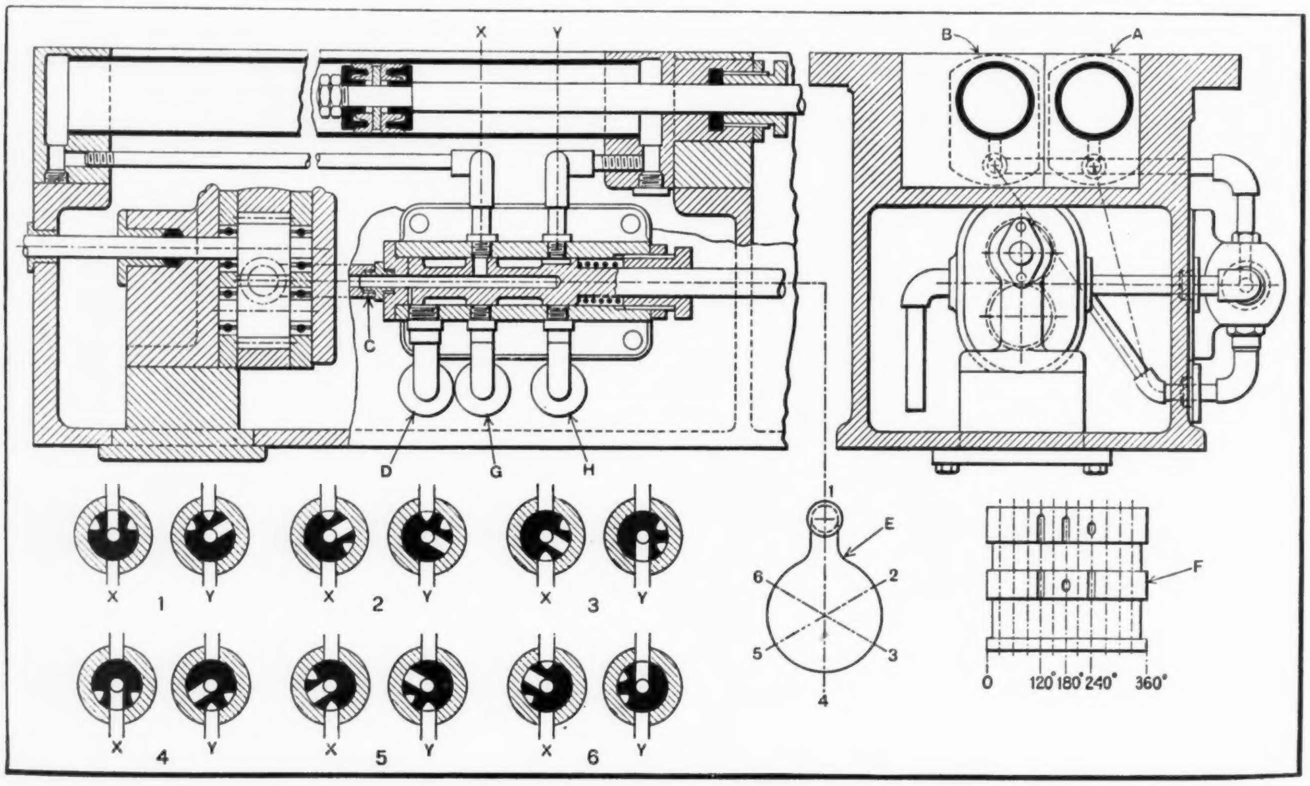


Fig. 17. Hydraulic Valve for Controlling the Movements of Pistons in Two Cylinders

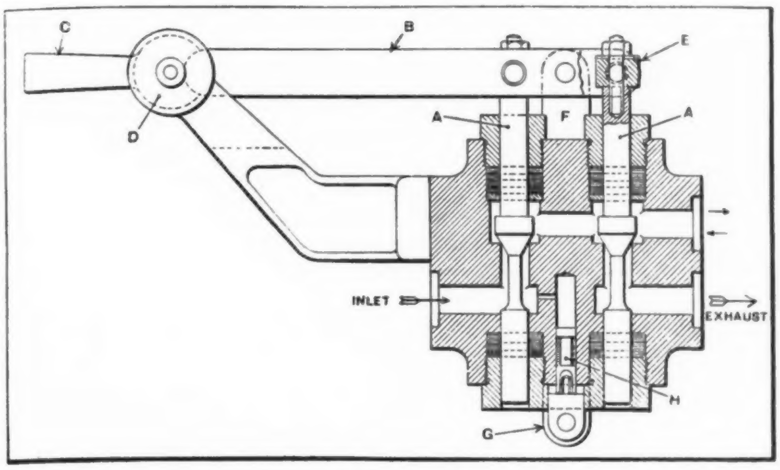


Fig. 18. Automatic Valve for High-speed Operation

The control valve is, therefore, spring-loaded, so that surplus pressure oil, which, under normal feeding rates is allowed to escape in limited quantities through a small duct as it enters the valve chamber, may, as pressure becomes excessive, force the valve to the right, thus uncovering the exhaust port *D* and allowing the oil to return. In addition, the spring will function as a safety valve if the movement of the slides is obstructed or the feed excessive, so that a table or slide may be run against a positive stop without danger of breakage.

The valve section diagrams through *X* and *Y*, numbered 1 to 6, and the lever positions similarly numbered, give the following sequence of movements to the pistons in cylinders *A* and *B:* Cylinder *A*, Position 1: *X*, forward feed; *Y*, free circuit. Cylinder *A*, Position 2: *X*, free circuit; *Y*, free circuit. Cylinder *B*, Position 3: *X*, free circuit; *Y*, reverse feed. Cylinder *B*, Position 4: *X*, forward feed; *Y*, free circuit. Cylinder *B*, Position 5: *X*, free circuit; *Y*, free circuit. Cylinder *A*, Position 6: *X*, free circuit; *Y*, reverse feed.

It will be apparent that the valve lever rotation is reversible, so that there is no necessity to pass through intermediate positions to change from forward to reverse feed, for positions 3 to 4 control these functions for cylinder *B*, and positions 6 to 1 for cylinder *A*.

Automatic Valve for High-Speed Operation

The conical or automatic type of valve shown in Fig. 18 can often be adopted to advantage, for its speed of operation is unequalled by any other type, and in addition, it has a very delicate control. This valve, known as the "Homeyard" (Glenfield & Kennedy, Kilmarnock, Scotland), combines these advantages in a marked degree, pressure of the thumb and finger serving to operate it when working under a pressure of 1000 pounds per square inch.

As shown in the illustration, a body carrying two spindles *A*, has one arranged to act as an inlet and the other as an exhaust valve. The spindles are connected by the lever *B* and two cross-heads *E* at the upper ends. Midway between the cross-heads, a pin and two side links *F* are fitted to pass down the sides to the bottom of the body, where they are connected to a cross-head *G*. A small ram *H* bears on this cross-head, the hydraulic pressure coming from a small hole drilled through the inlet port. This pressure is transferred through the side links to the valve spindles, which are of equal diameter, the valves being kept closed and in equilibrium.

The operating lever *C* may be arranged horizontally or vertically as required; but when the handle is moved up or down, it moves the engaging end of the valve spindle in the opposite direction, and so raises one or the other of the valve spindles, the one at rest in its seat forming the fulcrum. If the handle is moved sufficiently, it throws the rounded end of the lever out of the recess in the cam-plate *D*, so that it rests on the cam circumference and locks the valve in the open position. As soon as the lever end can enter the recess, both valves are closed down on the seats.

The double-ported valve shown in Fig. 19 will supply both ends of a double-acting cylinder or two

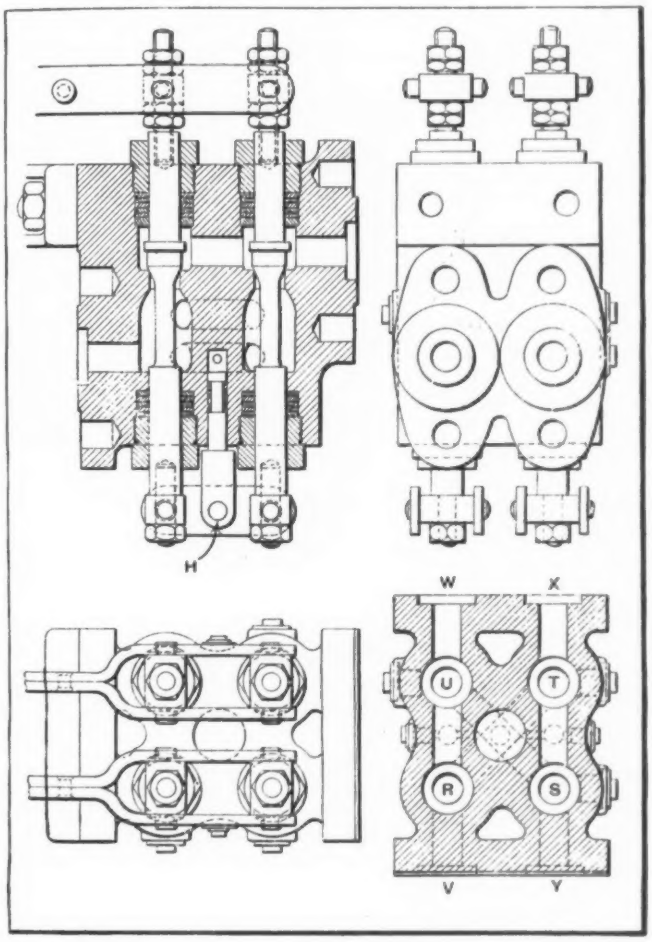


Fig. 19. Valve with Double Ports for Supplying Both Ends of a Double-acting Cylinder or Two Single Cylinders Working against Each Other

single cylinders working against each other. The action of this valve is as follows: When the operating lever is raised, lifting the pressure and exhaust valves R and S, the valves T and U are down, the seats acting as fulcrums for the valve levers. The pressure fluid, entering at V, passes up through the valve R and across past the valve U, then through the branch W to one end of the hydraulic cylinder, the exhaust from the opposite end passing through X, past the valve T down through the valve S, and so to exhaust through Y.

Manipulation of the lever in the opposite direction causes R and S to act as fulcrums and lifts the valves T and U. The pressure fluid, again entering at V, finds the valve R closed and passes through the diagonal port across to the chamber under the valve T, which, being open, allows the fluid to pass to the cylinder by way of the port X. The exhaust from the opposite end simultaneously returns through the port W down through the valve U, across by way of the diagonal port to the chamber underneath the valve S, and so to the exhaust port Y. The rams H are supplied with oil under pressure from the inlet diagonal passage by a hole drilled through the body and plugged at its outer ends.

Coolant Filters for Grinding Machines

By H. P. CHACE, Sales Engineering Department
Machine Division, Norton Co., Worcester, Mass.

THE value of some sort of filtration of grinding coolant to remove particles of wheel grit and metal chips has been recognized in connection with certain grinding operations for many years. The need for grit-free coolant is most apparent when fine-grit wheels are used to produce a high finish on work such as hardened steel rolls for cold-rolling metal. The reason is that fine-grit wheels are dense and particles of abrasive carried in the coolant between the wheel and the work cannot embed themselves in the pores of the wheel face; consequently, they are likely to scratch the work.

Early attempts to filter coolant were purely for preventing scratches and thus improving the finish produced. It was not unusual for operators to tie a fine muslin bag over the water pipe nozzle. Many homemade filters were also in use, and for some operations—notably steel and copper roll grinding—clear tap water was used, lest grit should scratch the work. This practice is still followed by many roll-grinders.

However, there have been developed and placed on the market in the last few years many excellent mechanical filters which can be installed in the coolant supply line of most cylindrical grinders. Their use is frequently recommended by grinding machine manufacturers, and, in many cases, machines are sold equipped with filters. Their application seems to be principally for the improvement of finish, although other advantages have been proved that should make their use much more general. Not only are scratches reduced or prevented and a better finish obtained, but the grinding wheel faces are kept clean, so that they cut better and require less dressing. This results in a reduction of abrasive costs through longer wheel life and higher production, because of the better wheel action and less time lost in wheel dressing.

There are several points to be considered in the selection of an efficient filter for grinding coolants. First, the filter must actually remove grit and dirt from the coolant; second, it must make some provision for storing the dirt; third, it should be so constructed that the dirt can be easily and quickly removed by the operator when the storage space becomes filled; and fourth, it must have ample capacity so that the volume of coolant delivered to the wheel and work is not reduced.

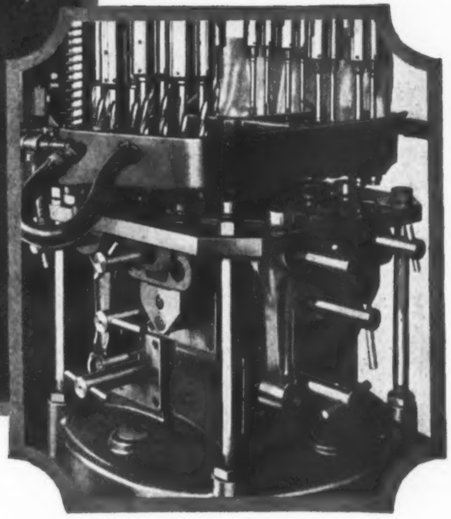
The filtering principle, whether it involves a series of baffle plates, centrifugal action, or the forcing of the liquid through a fibrous or porous substance, is of no great concern, but the facilities for cleaning are very important. Of course, whether a filter is used or not, the sludge must be cleaned periodically from the tank and pipes of any grinding machine. This is a messy job, and for that reason, is not always done as often or as thoroughly as it should be. A good filter, therefore, should make the keeping clean of the coolant circulating system easier and less unpleasant.

* * *

Meeting of Acetylene Association

The International Acetylene Association, with headquarters at 30 E. 42nd St., New York City, will hold its thirty-eighth annual convention in Birmingham, Ala., November 10 to 12. The program includes papers and discussions on almost every phase of the welding industry, and will appeal to anyone engaged in the welding or cutting of metals. Three main sessions will deal, respectively, with "Speeding Manufacture and Construction with Oxy-Acetylene Welding;" "How and Why to Use Oxy-Acetylene Cutting;" and "Maintenance and Operations in the Oxy-Acetylene Process." The meeting will also include roundtable discussions on a great number of subjects of general interest to those seeking further information on welding and cutting practice.

Design of Tools and Fixtures



Fixture for Grinding Formed Cutters

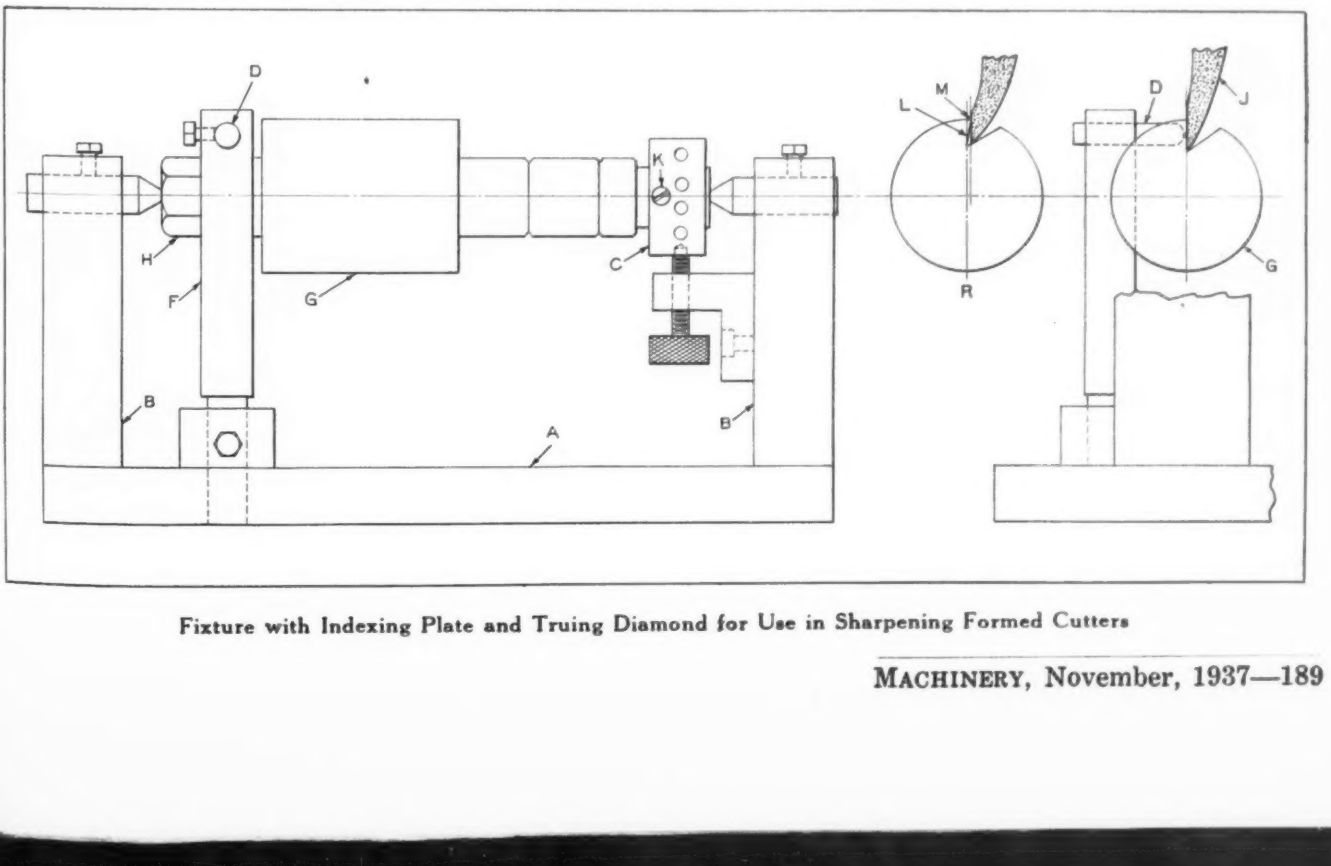
By HECTOR J. CHAMBERLAND, Springfield, Mass.

The fixture illustrated is designed for accurately sharpening formed cutters. It is intended for small shops where the number of cutters employed does not warrant the purchase of more expensive equipment. On the baseplate *A* are bolted or welded uprights *B*, a T-slot being milled in the plate when regular indexing centers are available which can be used in place of the uprights *B*. Various indexing plates *C* can be made to suit the number of flutes in the cutters.

The general construction of the fixture can be one of individual choice, the main feature being the diamond wheel-dresser *D*, held in post *F*, which actually governs the accuracy of the work. The post should be located about as shown in the diagram, just back of the arbor and as close to it as possible without danger of interference. Means should be provided for a 3/4-inch vertical adjustment of post *F*. The diamond point is permanently set in a radial plane in line with the arbor centers.

The first step in grinding is to mount cutter *G* on the arbor without tightening the clamping nut. Next, the saucer-shaped wheel *J* is dressed. This dressing operation locates the grinding surface of the wheel radial with the centers. The arbor is then placed between centers and the index-plate *C* is locked with the screw *K*. The face of the poorest or dullest flute should then be brought in contact with the grinding side of the wheel. The cross-feed table is moved backward to take about a 0.010-inch under-cut, as indicated at *L*. The tooth face is again brought into contact with the wheel as at *M*, the arbor nut *H* and screw *K* having been tightened.

In grinding the first flute, its face advances



Fixture with Indexing Plate and Truing Diamond for Use in Sharpening Formed Cutters

toward the wheel, its radial location being reached as the diamond point comes in contact with the wheel. This method will guarantee the equidistance of all cutting edges. With the arrangement shown, the wheel is automatically dressed before grinding the next tooth or flute.

The view to the extreme right shows how the wheel is in contact with the diamond point when it has reached the radial line. At *R* is shown an enlarged view of the radial and under-cut lines before grinding.

Combination Die for Blanking, Drawing, Piercing and Trimming Shell

By JOHN J. McHENRY, Detroit, Mich.

The shell shown at *A* in Fig. 1 requires the outer edge to be square and the full thickness of the metal, with the drawn hole or collar concentric with the outer walls. This shell is successfully made from cold-rolled steel 0.038 inch thick by the punch and die shown in Figs. 1 and 2. A plan view

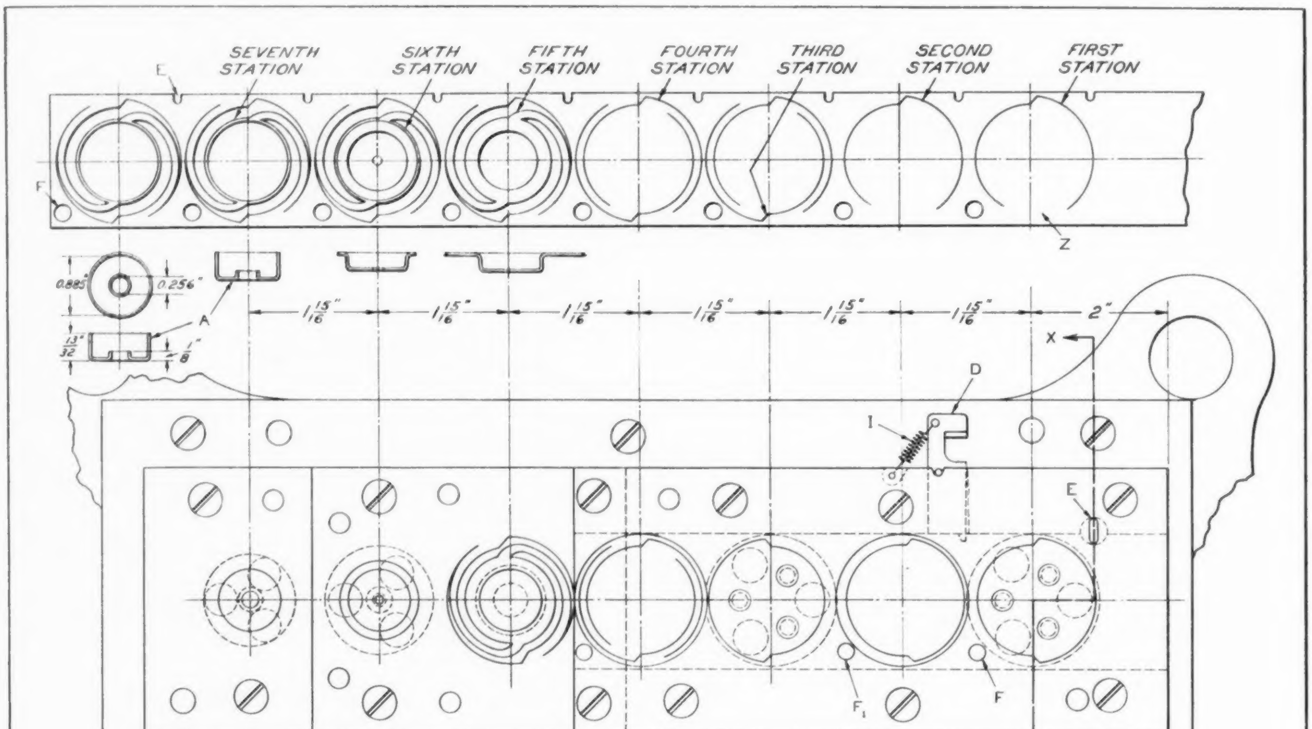


Fig. 1. (Upper View) Strip Stock, Showing Progressive Operations Performed on Die Shown in the Two Lower Views; (Two Lower Views) Plan View of Die and Cross-section of Punch and Die for Producing Shell A

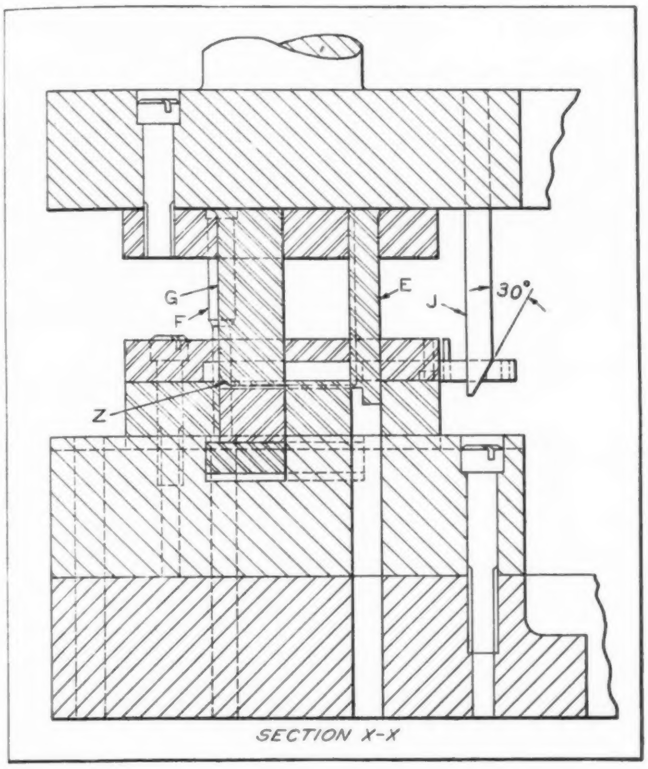


Fig. 2. Cross-section X-X of Punch and Die Shown in Fig. 1

of the strip stock from which the shells are produced is shown above the plan and elevation views of the die, Fig. 1.

The strip stock is entered at *Y* between the fixed stripper *B* and die *C* and advanced against the trigger stop *D*, which it presses to the left 1/32 inch to the position shown. The indexing notch is cut by the punch and die at *E* on the first downward stroke of the press ram, the pilot hole is pierced by the punch and die at *F*, the blank is partially cut by punch *G*, and the stop *D* is withdrawn by the tapered pin *J*, Fig. 2.

Punch *G* is ground away on its cutting face for about 7/8 inch, lineal measurement, to prevent cutting the stock on one side, as shown at *Z*, Fig. 1. The manner in which the punch is ground away is shown at *Z*, Fig. 2. On the up stroke of the press ram, the partially blanked part is ejected by the spring-actuated shedder *H*, Fig. 1, trigger *D* is brought back to the edge of the strip stock by the spring *I*, and the stock is advanced to the next station, being located by stop *D*, which enters the slot previously cut by punch *E*.

On the second downward stroke of the press ram, the operation at the next or second station consists only of pressing the partially blanked work back firmly into the strip stock. This is done by the flattening punch *Q*. The strip stock is located by a pilot which passes through hole F_1. On the up stroke of the ram, the strip stock is advanced to the next station.

On the third downward stroke, the second partial blanking cut is taken, exactly as was the first one, except that the incompleted cut is at the opposite side of the punch *L*. On the fourth stroke, the operation is exactly the same as on the second stroke and requires no further explanation. Next, the stock is advanced to the fifth station, where the die construction is somewhat different, a spring stripper or blank-holder *M* being used instead of a stripper of the fixed type.

On the fifth stroke, the blank is held with the necessary resistance to prevent wrinkles, by the blank-holder *M*. The shell is drawn 5/16 inch deep by punch *N*, and on the up stroke, the drawn shell is ejected by the spring-actuated pad *O*. The carrying fingers left on the work by the reduction of the partial blank are shown at the fifth position on the die and in the upper view, Fig. 1.

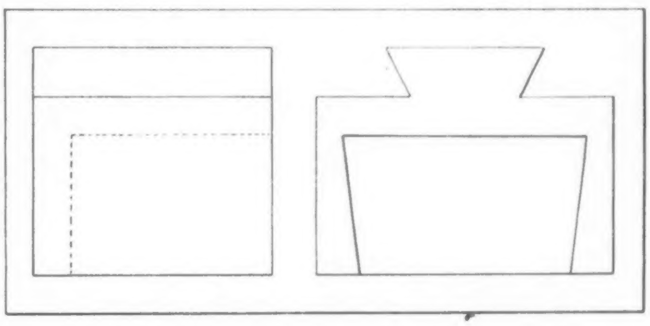
After the strip stock is advanced to the next or sixth station, the press ram descends, blanks the shell, and pierces the central hole. The piercing of a hole against spring pressure, as done at this station, is unusual and ordinarily is not recommended, but in this instance, it has proved entirely satisfactory. A pilot *P* assures concentricity of the blanking and piercing punches *R*. On the up stroke of the ram, the shell is pressed firmly back in the strip stock by the resistance between the spring-actuated die-head *S* and the blank-holder *M*. The strip stock is next advanced to the seventh or last station, where a solid type of stripper is used.

On the seventh descent of the press ram, the shell flange is straightened up by punch *T* and die *U*. The center hole is also drawn concentric by the punch *V*. On the up stroke of the ram, the shell is forced out of die *U* by a spring-actuated shedder *W*, and is carried up on the punch, from which it is stripped by the solid type of stripper *K*. The shell falls on the die face, in the strip stock hole from which it was blanked. As the strip stock is advanced, it carries the completed shell out and over the end of the die. A shell is completed at this station at each stroke of the press.

Special Chuck Jaws for Holding Globular or Irregular-Shaped Work

By FRED HORNER, Bath, England

False jaws with cavities or recesses such as shown in the accompanying illustration, in which irregular-shaped parts can be located while white



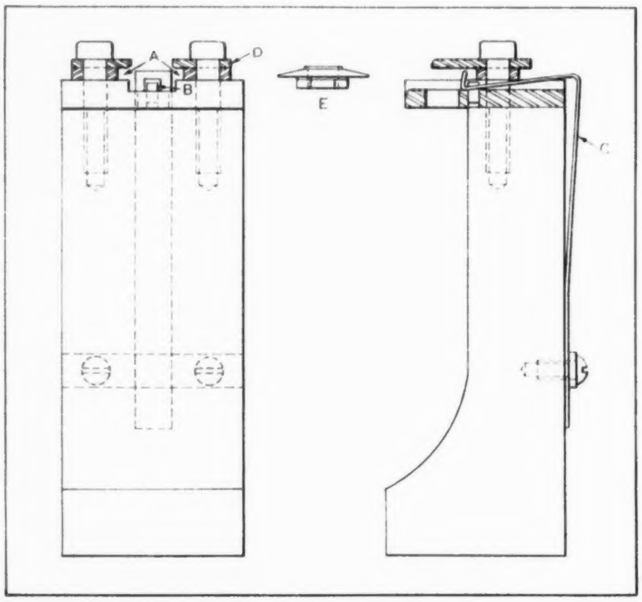
False Chuck Jaws with Cavity for Casting White Metal around Work

metal is cast around them, provide a simple means of producing jaws having adequate support for this kind of work. Jaws made in this way are recommended for use on chucks of the two-jaw type.

Tapping Fixture for Hexagonal Clinch-Nut

By H. GOLDBERG, Vice-President
R. G. Haskins Co., Chicago, Ill.

The simple fixture shown in the accompanying illustration has made possible the rapid tapping of hexagonal nuts like the one shown at *E*. The nut is placed in the opening *A* and pushed back against



Tapping Fixture with Spring Ejector

the stop-pin *B*. This moves the spring *C* back while the nut is being tapped. The stripper plate *D* serves to hold the nut down. After the tap has been reversed, the spring *C* kicks the nut out into a chute. A variety of similar parts having flats which make it unnecessary to clamp the work can be handled in this style of fixture.

* * *

According to figures collected by the Automobile Manufacturers Association, Detroit, Mich., there has been an increase in the prices of raw materials and semi-fabricated products used in automobile manufacture of over 20 per cent in the last year. Typical increases include 20 per cent in automobile body sheet steel, 17 per cent in forging steel, and 27 per cent in cast iron, which materials together make up roughly one-half of the cost of the materials in an automobile. Copper, lead, and zinc have advanced approximately 45, 28 and 38 per cent, respectively. The prices are those for July, 1937, compared with the average prices in 1936.

Wrought Washer Mfg. Co. Fifty Years Old

A small plant known as the Nut & Washer Mfg. Co. started business in Milwaukee, Wis., fifty years ago in a small building, 30 by 60 feet. The outgrowth of this small business is the present Wrought Washer Mfg. Co. of Milwaukee, which is celebrating its fiftieth anniversary this year. This company is said to be the largest producer of washers in the world. One of the founders of the company was Fred Doepke, who was president for many years until his death in 1934.

When the company started in business in 1887, it produced about a ton of washers a day. Today the plant is equipped to produce seventy tons of washers a day, of thousands of sizes and shapes, for the production of which close to 20,000 sets of tools are required.

The growth of the business was rapid from the very beginning. Two years after it had been started, it was found necessary to move to new and larger quarters. Six years later, the company found it necessary to build its own plant. The facilities of this plant sufficed until 1901, when the first unit of the present plant was built. From time to time new building units have been added. At present the company is going forward with plans for an entirely new plant in the outskirts of Milwaukee, where several buildings have already been erected.

* * *

Transferring Blind Hole Lay-Outs

By J. P. KIRSCHENSTEINER

In July MACHINERY, page 709, there was an article on transferring blind hole lay-outs. The methods described are sufficiently accurate for the general run of work, but there is a possibility that the markings used to locate the holes may be disfigured or removed. In cases where this is likely to happen, the well known cone-point set-screws may be used. The pointed set-screws are screwed into the blind holes, leaving the points projecting so that they may be employed to produce center punch marks in the mating part to be drilled.

Trouble is sometimes encountered in removing the cone-pointed set-screws, but this can easily be remedied by the use of a flat file. The edge of the file is pressed firmly against the projecting end or side of the set-screw and moved in the proper direction for backing up or unscrewing the set-screw.

* * *

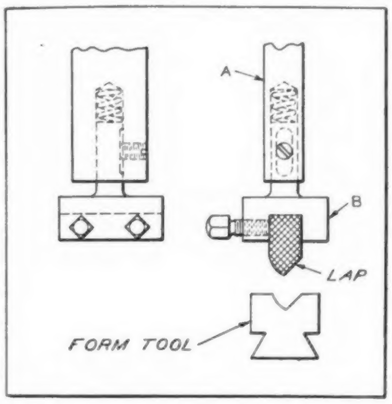
Those who claim that machinery causes unemployment might ponder the fact that, in 1936, there were 3,000,000 truck drivers in the United States. Are we to believe that that many teamsters were replaced, or did not the machines that built the trucks aid in employing more people?

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

Lapping Forming Tools in a Shaper

The device shown in the accompanying illustration is used for removing tool marks from forming tools after hardening by lapping them in a shaper. It is clamped in the toolpost of the shaper, while the forming tool is held in the vise, the lapping being accomplished by the oscillating motion of the shaper ram.



Lap for Form Tool

The holder *A* has a hole bored in one end to receive stud *B*, which is backed up by a coil spring that presses the lap against the work under the desired pressure and also compensates for any hardening distortion that may be present, in case the forming tool has not been previously ground.

The lap, which is made of some suitable material such as copper or lead, is held in the groove of the stud by two small set-screws. The shank of the stud has a flat machined on one side to accommodate the small set-screw contained in the holder. The set-screw is adjusted against the shank to permit a very slight swiveling motion, and it also acts as a retainer for the stud. When in use, the shaper stroke is so adjusted that the lap does not leave the work. The clapper-box of the shaper should be locked to prevent it from pivoting or being lifted on the return stroke.

Meriden, Conn. PETER L. BUDWITZ

Rack and Pinion with Backlash Take-Up

A rather unique method of taking up backlash between a rack and pinion is shown in the accompanying diagram. This arrangement is used on the cutter-head of a profiling machine which is operated manually through a rack and pinion. As it is necessary for the head to respond immediately to the operation of the hand-lever, any backlash between the rack and pinion is not permissible.

Shaft *A* carries the pinion *B*, which is keyed to it, and also the pinion *C*, which is free to turn on the shaft. Pinion *C* carries three conical pins *E*, which engage three countersunk holes in pinion *B*, as shown in the cut-out section *X–X*. Shaft *A* is threaded on the outer end to carry two nuts, which draw the pinions *B* and *C* together. Pins *E* are so located that when they are aligned with the holes in pinion *B*, the teeth in pinion *C* overlap those of pinion *B* about one-quarter of the tooth space.

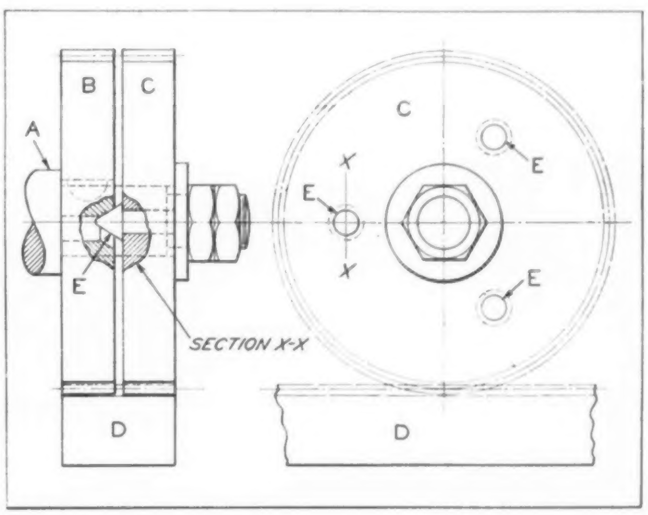
When pinions *B* and *C* are new, and mesh perfectly with rack *D*, they will be in the relative positions shown in the diagram. As the teeth become worn, permitting backlash, the pinions *B* and *C* are drawn slightly closer together by turning the inner nut.

The tendency of pins *E* to become centralized in the countersunk holes causes the pinion *C* to be given a partial rotation with relation to pinion *B*. This produces a slight misalignment between the teeth of pinions *B* and *C*, so that any lost motion between the teeth of the pinion and the rack *D* is taken up. The outer nut is used to lock the inner one after the adjustment has been made.

Philadelphia, Pa. L. KASPER

* * *

The passenger cars on American railroads that were air-conditioned up to July, 1937, numbered over 9300. The number is constantly being increased, both the railroads and the Pullman company proceeding at a rapid rate with air-conditioning of passenger cars. Approximately one-half of the cars air-conditioned belong to the Pullman company and one-half to the railroads.



Rack and Pinion Arranged to Permit Taking up Backlash

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

Machining Nickel and Monel Metal

G. O.—Please furnish some instructions for the machining of nickel, nickel alloys, and Monel metal.

A.—In a paper presented before the last annual meeting of the American Society of Mechanical Engineers, F. L. LaQue of the International Nickel Co., Inc., outlined various properties of nickel-base alloys. He also gave detailed directions for the machining of Monel, nickel, and Inconel. These metals and alloys, being tougher and stronger than mild steel, must be machined at slower cutting speeds and with lighter cuts. The tools should be made from 18-4-1 high-speed steel, hardened to about 65 Rockwell C, and the cutting edges should be ground to sharper angles than for steel.

Honing of the tools is recommended. Sulphurized oil should be used freely as a lubricant for boring and drilling, and is preferred for general work, although water-soluble oils will suffice for lathe work. A special type of Monel that can be machined at high cutting speeds is available for automatic screw machine work. This is known as R-Monel.

Tools for cutting Monel differ from those for cutting steel in that a slightly larger rake angle back from the cutting edge is required. This holds true for all cutting tools. A good lathe tool for medium cuts will have the following angles: Back-rake angle, 6 to 8 degrees; side-rake angle, 15 to 18 degrees; side clearance, 6 degrees; end clearance, 8 to 12 degrees; and nose radius, 1/16 to 3/16 inch, depending on the depth of cut.

With K-Monel and Inconel, the clearance angles should be kept at the minimum, and for heavy cuts, the grinding of a small land of about 1/32 inch at the cutting edge is advantageous.

Standard twist drills as furnished by drill manufacturers have proper angles for general-purpose work. Only high-speed or super high-speed steel drills should be used; polished flutes are preferable. Sulphurized cutting oils give best results. The recommended speeds for regular Monel and nickel are between 40 and 60 feet per minute, with the same feeds as those commonly recommended for mild steel. R-Monel can be drilled at a speed of from 60 to 75 feet per minute. Lowering the drilling speed to between 30 and 45 feet per minute for Inconel, and to between 20 and 30 feet per minute, with 75 per cent of the standard feed, for soft K-Monel is necessary.

Reamers must be kept sharp. Speeds are approximately from 25 to 30 feet per minute for Monel and nickel, and about 10 to 15 feet per minute for K-Monel and Inconel. Feeds are approximately twice the recommended drill feed for the same size of hole.

For general practice in milling Monel and nickel, an average cutting speed of from 50 to 65 feet per minute, with a feed of from 0.005 to 0.010 inch per tooth, depending on the depth of cut, is usually satisfactory. With Inconel and K-Monel that has not been heat-treated, the surface speed of the cutter must be reduced to approximately 40 feet per minute, with a feed of from 0.003 to 0.006 inch per tooth.

Regular Monel and nickel can be tapped at a speed of from 20 to 25 feet per minute. K-Monel that has not been heat-treated and Inconel can be tapped at approximately 12 to 15 feet per minute. R-Monel can be tapped in automatic machines at a speed of from 25 to 35 feet per minute.

Machinery Held in Warehouse

L. M. C.—How long is it necessary for a warehouseman to hold machinery in a warehouse before he can dispose of it for the storage charges? Can the warehouseman sell it without notifying the owner?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

A warehouseman who desires to sell machinery for storage charges is required to mail a registered letter notifying the owner of the machinery of the intended sale. If the owner fails to pay the account, the warehouseman is required to advertise the intended sale for a period of time specified by the laws in the state where the warehouse is located. The goods must be sold in strict accordance with the laws of that state. Any variation from these laws makes the warehouseman liable to the owner for the full value of the machinery.

* * *

The factory sales of American automobile manufacturers for September this year were 20 per cent above the corresponding month last year. According to the Automobile Manufacturers Association, the industry manufactured and shipped during the first nine months of this year very nearly 4,000,000 cars and trucks, an increase of 14 per cent over the same period last year.

Machine Tool Builders Discuss Current Problems

THE thirty-sixth annual meeting of the National Machine Tool Builders' Association was held at The Homestead, Hot Springs, Va., October 25 to 27. A number of outstanding papers were read, relating especially to current business problems, methods of taxation, and Federal regulation.

In his opening address, "More Goods for More People," the president of the Association, Clayton R. Burt, president, Niles-Bement-Pond Co., Hartford, Conn., reviewed the current relations of business and government with special reference to the machine tool industry. "The great objective of the machine tool industry," said Mr. Burt, "is the extension of the general well-being that is so concisely expressed in the phrase 'More Goods for More People.' The development of production, transportation, and communication to their present highly mechanized state has been accompanied by a steady growth in employment, and a richer, more abundant life for the masses of the people."

Mr. Burt pointed out that the steady flow of more and better goods to an ever-growing population is the avowed aim of the Administration at Washington. "The difficulty," said Mr. Burt, "is that Washington has some novel plans, yet unproved, regarding the *distribution* of goods to more people, but has neglected the important point that there must also be more goods *produced.*

"It is apparent that a very important requisite has been overlooked, namely, understanding and appreciation on the part of the government of the problems of industrial management. It is vitally necessary for industry to cooperate with the Administration, and this the machine tool industry has faithfully tried to do, but it is quite as necessary for all branches of the government to cooperate with the managers of industry. That has not been done, and persistence in this course is dangerous. Highly restrictive legislation, intended to help the working classes, has handicapped some industries to such a degree that it is doubtful whether they can survive if these policies are continued."

Commenting upon the 1936 Revenue Act, Mr. Burt said, "As one example of misdirection on the part of the government, due to a lack of comprehensive understanding of industry's financial problems, I cite the Tax on Undistributed Surplus. This particular legislation will defeat the aims of the Administration in several directions, not the least among them being the stabilization of production and employment. Those who were responsible for this law were not fully informed of the importance of corporation reserves to the country during the bad years of 1930 to 1934. During these years, while the government spent $8,000,000,000 in an effort to restore a normal balance, corporations spent over $18,000,000,000 more than they received. To do this, they not only had to have a surplus on hand, but that surplus had to be readily available in cash or quick assets."

The speaker then pointed out how most industries used this surplus to retain skilled workmen at all kinds of odd jobs throughout the depression. At no time during the depression did employment fall as low as the indexes of production. Research, redesign, and development of new products, for which there was no immediate market, provided work for a sizable staff when business was dull. The estimated loss in capital and surplus of the machine tool industry during the depression amounted to between 35 and 40 per cent of the financial strength of the industry. Any conservative executive must consider it his first duty to restore his depleted cash reserves when business returns, in order that his company may be prepared to face the next emergency. The surplus tax provision, by making this almost impossible, places a heavy penalty on industry in general, and especially on the machine tool industry.

Furthermore, to furnish more goods to more people, with our increasing population, industry must expand. The normal growth of a corporation is ordinarily financed out of surplus. In this direction also, the surplus tax provision places a serious obstacle in the way of needed expansion.

"Rising labor costs," continued Mr. Burt, "without commensurate increases in labor efficiency, likewise constitute a restriction on production. The machine tool industry is not opposed to increased wages, but it believes in so improving the efficiency of industry as to increase the output per man employed, thereby making higher wages possible. The industry is, however, opposed to arbitrary increases by legislative measures, because such increases are unsound. They benefit a few at the expense of other workers not equally favored. They inevitably cause higher prices and decreased consumption."

Among other papers read before the convention were: "Federal Regulation of Private Employment," by J. A. Emery, general counsel of the National Association of Manufacturers; "The Business Horizon," by Dr. Lewis Haney of New York University; "The National Outlook," by Raymond Moley, Editor of *News-Week;* "Man Power and Machine Tools," by A. C. Danekind of the General Electric Co.; and "The Maintenance of Ethical Standards," by Ralph E. Flanders, president of the Jones & Lamson Machine Co.

Torch-Hardening of Gear Teeth

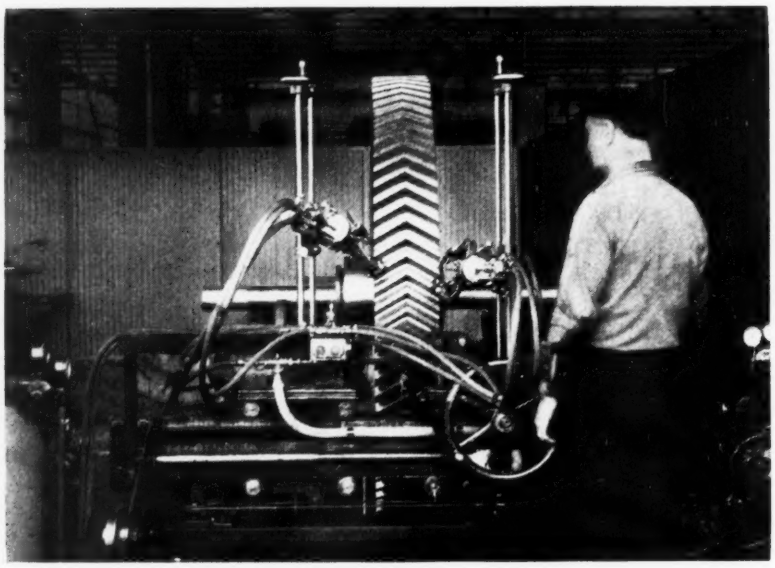


Fig. 1. Torch-hardening Equipment Ready to be Applied to a Herringbone Gear

Abstract of a Paper Presented by W. E. Sykes of the Farrel-Birmingham Co., Inc., Buffalo, N. Y., Before a Recent Meeting of the American Gear Manufacturers Association

THE technique of hardening gears below, say, 12 inches in diameter has been well developed, but the hardening of larger gears has presented some difficulties. Some of these larger gears are furnace-heated and afterward quenched; others are carburized and quenched. The application of larger gears so hardened is, however, confined to somewhat low speeds, due to the fact that it is impracticable to limit the distortion to a very small amount.

For a long time there has been a need for a method of hardening the teeth of large gears without appreciable distortion. When the nitriding process was introduced about twenty years ago, it was thought that it would be useful for large gears; but it has not proved as universally applicable as was expected. The nitriding process is slow and expensive when applied to large gears, and the depth of hardness is not so great as desired. Moreover, the surface hardness resulting from the nitriding process is so great that it tends to make the metal brittle.

Recently, considerable progress has been made in the hardening of gear teeth by means of an oxy-acetylene flame, followed by a quick quench. This idea is not new; it was practiced twenty years ago, but made little headway until the introduction—some seven or eight years ago—of a machine that could guide mechanically a suitable torch fitted with a water jet. This development was pioneered in England by A. E. Shorter, and the method has since been adopted in the United States.

The process has the appearance of being remarkably simple, which has perhaps been its greatest disadvantage, as it has commonly been assumed that it is a simple matter to devise a mechanical method for guiding a torch with an attached water jet. The haphazard way in which the operation has been carried out, however, has often caused disappointing results, and, in consequence, torch-hardening has been thought an unsuccessful process.

It is thoroughly recognized that, in using a carburizing process or any other hardening method, a suitable steel must be employed. In view of this, it is strange that many experienced engineers should have expected the torch-hardening process to operate successfully with almost any kind of material. It is obvious that the application of a torch to poor steel will not eliminate impurities and other defects. A poor material torch-hardened—or hardened in any other way—may give less satisfactory results in service than if it were unhardened. It is easy with the torch-hardening method to ruin an otherwise good gear; and it is also easy to make a poor gear into a hopelessly bad one.

In considering the torch-hardening process, one should bear in mind that by its use, steel is heated to a rather high temperature and rapidly quenched; hence a steel suitable for this treatment should be used. Present experience indicates that a non-alloy steel containing from 0.4 to 0.6 per cent carbon is suitable. Some of the alloy steels have also given good results, but greater care is necessary in applying the correct heat and also in applying the quenching fluid at a correct distance from the heating flame. Steel castings containing as low as 0.3 per cent carbon, with a high percentage of manganese, have been hardened satisfactorily.

One of the difficulties in using the process is to gage the temperature of the heated metal. The

author knows of no really satisfactory pyrometer or other temperature-measuring instrument that is applicable to the torch-hardening method. Furthermore, it seems that the only method of ascertaining the hardness of the gear tooth correctly is by removing it from the gear, which, of course, is impracticable except for experimental purposes. None of the available hardness-testing instruments are adapted for application to the surface between two gear teeth.

However, even though we cannot measure the temperature or the hardness, but still get good results from the gears, there is no reason to question the value of the process. In nearly all developments, the method or machine has come first and the instruments for measurements and inspection later.

The Farrel-Birmingham Torch-Hardening Machine

A torch-hardening machine developed by the Farrel-Birmingham Co. was illustrated and described in June, 1937, MACHINERY, page 687. Other applications of this machine are shown in the accompanying illustrations, Figs. 1 and 2. This machine has been especially developed for hardening gears with parallel axes. No attempt has been made to apply it to the hardening of worm-gears or bevel gears. However, a machine for hardening bevel gears has been developed by the Gleason Works.

Fig. 1 shows the torch or heating equipment. There are two torch heads, each of which carries two jets for the mixture of oxygen and acetylene. Each jet impinges on one side of the gear tooth, with the result that when herringbone gears are being hardened, four jets are in simultaneous operation; thus the right-hand helix of one tooth and the left-hand helix of another tooth are hardened simultaneously. When single helical gears are hardened, one pair of jets only may be used; or two pairs may be used, one pair working on one gear and the other on a second gear, the two gears being ganged on one arbor. A similar method can be used for hardening straight teeth or splines. In Fig. 2, for example, the splines at the end of a shaft are being hardened.

The torch heads are provided with mechanisms for making suitable adjustments for correctly positioning the flame jets and the water jets. These adjustments are very important. The water supply is carried in a tank which forms part of the base of the machine and is brought to the water nozzles, located behind the flame nozzles, by a motor-driven pump. The temperature of the water is controlled by having a constant supply running into the tank from the water main while a constant amount is drained from the other end of the tank. A constant water pressure is necessary; direct connection of the water nozzles to city water mains has proved troublesome because of variable water pressure.

When helical or herringbone gears are being hardened, it is necessary to rotate the gear in unison with the movement of the torches. This is accomplished by means of a pin guide fixed to the traverse saddle of the machine which engages the teeth of the gear. This pin is also used as an indexing device.

Up to the present, this machine has been found suitable for hardening teeth from 1 to 4 diametral pitch. It has been used for pitches as fine as 6 diametral pitch, but it is not so satisfactory for the fine pitches as for relatively coarse pitches. It is believed that it is practicable to harden as fine as 8 diametral pitch teeth; but when the pitches are so fine, the depth of hardness needs to be very precisely controlled, and the work is tedious and slow. It can be readily seen that to harden 100 teeth of 6 diametral pitch takes nearly as long as to harden 100 teeth of 1 diametral pitch, and there is less to show for the labor and expense involved when fine-pitch teeth are being hardened. Fine-pitch gears, however, are usually of small diameter and can be more satisfactorily hardened by other methods.

It has been necessary to ascertain by experiments the correct gas pressures and flames for different pitches and different materials. These data are now in tabulated form, so that an operator can work to a chart, thus obtaining uniform and satisfactory results.

Hardness Obtained by the New Process

One question often asked is: "What is the hardness obtained?" It has been found that it is possible to obtain any hardness between 60 and 80 scleroscope, or 400 to 550 Brinell. Experience

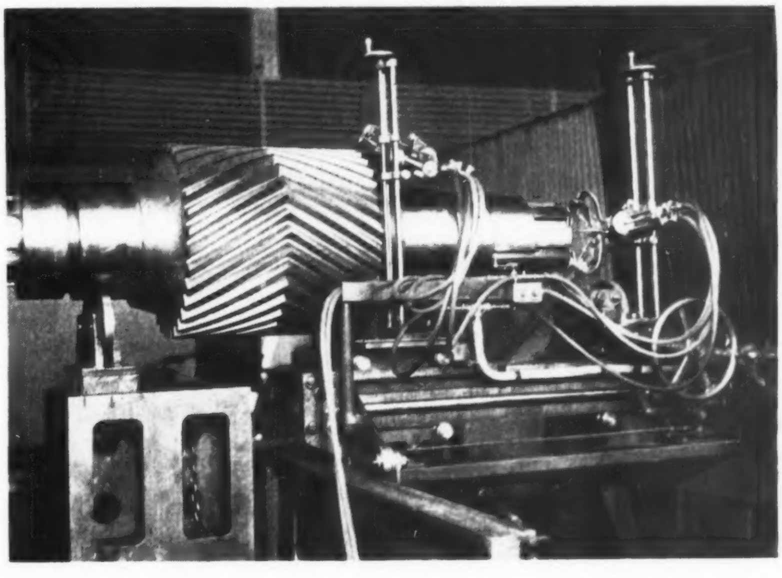


Fig. 2. Torch-hardening Equipment Used for Hardening Splines at the End of a Shaft

shows, however, that it is not desirable to obtain a hardness greater than 75 scleroscope. In fact, it may be that a hardness of about 70 scleroscope is better. It is not known with certainty whether a very hard surface on any gear tooth is desirable. The depth of hardness is, of course, important; but it is more important that the hardness decrease gradually from the surface of the tooth toward the core or center. A very sharp line of demarcation between the hardened portion and the soft portion should be guarded against. It is easy to get this undesirable result by heating the metal too hot and quenching it too quickly.

The question of the desirability of preheating and of drawing has been raised. The author has not found that either of these operations is necessary or desirable. Preheating, if desired, can easily be done without any appreciable extra expense, and a drawing operation can be carried out on the machine without great trouble; but it is believed that the latter operation, at least, would be detrimental.

Results Obtained with Torch-Hardened Gears

Some of the results obtained with torch-hardened gears in operation may be of interest. Up to the present time, there are approximately 700 pairs of gears that have been hardened on the machine described. These have given excellent results, with the exception of one pair, which showed some spalling near the ends of the teeth. However, it was found that this pair of gears was not mounted in true alignment. It was not possible to determine whether the undesirable effect was due to the torch-hardening or to the mounting of the gears. There are many sets in operation that have replaced similar gears unhardened; those torch-hardened have shown greatly increased life and are so far running satisfactorily without discernible wear.

It has been stated that torch-hardened gears will carry twice the load of unhardened ones. While it is probably true that a properly torch-hardened gear made of the correct material will carry at least twice the load of a gear made of the same material unhardened, it is by no means true that *any* torch-hardened gear will carry the same load as a gear of the same size made of a better material, unhardened.

Another mistake that many have made is to assume that because a gear is torch-hardened, it will stand great abuse and that it is not necessary to mount or lubricate it properly. A torch-hardened gear with only a 30 per cent bearing surface on the teeth cannot be expected to be better than an unhardened gear with a 100 per cent bearing surface. It may be less satisfactory than an unhardened gear; for if an unhardened gear is mounted out of alignment, it will more quickly wear to a reasonably large surface contact than a hardened one. Torch-hardening, or any other kind of hardening, will not eliminate faults in machining and mounting, and no hardening process will make bad steel into good steel.

It will be readily recognized that torch-hardening is not limited to gear teeth. It has already been used successfully in hardening many other machine parts. In the future, it is probable that every well equipped hardening shop will have facilities for torch-hardening. At the present time, this process is being applied abroad successfully for hardening automobile engine crankshafts, cams, and many other machine parts.

Meeting of Associated Machine Tool Dealers

THE annual meeting of the Associated Machine Tool Dealers, held October 11 and 12 at French Lick, Ind., was one of the best attended meetings of the Association. Among the papers read was one entitled "Sales Promotion," by Harry S. Robinson, secretary and sales manager of the Cincinnati Shaper Co., Cincinnati, Ohio, which emphasized the importance of adequate statistics in the sale of machine tools and the manner in which advertising can increase sales. F. B. Scott, Jr., of the Syracuse Supply Co., Syracuse, N. Y., in a paper on the "Training of Salesmen," outlined the methods used by his company in acquainting salesmen with the products sold by the company. He explained the manner in which the salesmen report calls, and called attention to the method by which the information so collected is tabulated and used for future sales promotion. H. R. Rinehart, secretary-treasurer of the National Supply and Machinery Distributors' Association, spoke on "Overhead Expense of the Distributor."

The following officers were elected: A. G. Bryant of the Bryant Machinery & Engineering Co., Chicago, Ill., president; John Sauer, Jr., of the Peninsular Machinery Co., Detroit, Mich., vice-president; and E. P. Essley of the E. L. Essley Machinery Co., Chicago, Ill., secretary-treasurer. The following were elected members of the executive committee: H. E. Oatis of the National Supply Co., Toledo, Ohio; F. W. Schiefer of the F. W. Schiefer Machinery Co., Rochester, N. Y.; and F. Rodger Lindsay of the Swind Machinery Co., Philadelphia, Pa. Harry Barney of the Barney Machinery Co., Pittsburgh, Pa., past-president, will also serve on the executive committee for the coming year.

* * *

Over 375,000 motor vehicles of American manufacture were sold abroad during the first six months of this year. This was a gain of 28 per cent over the same period last year. About 250,000 of these vehicles were passenger cars, the remainder being trucks.

Application of the Diamond Wheel to the Grinding of Cemented Carbides

Review of Development of Wheels for Grinding Cemented Carbides—Advantages of Diamond Wheels for This Purpose, and Detailed Directions for the Application of These Wheels in Carbide Tool Grinding—Second of Two Articles

By W. T. McCARGO
The Carborundum Co., Niagara Falls, N. Y.

IN the previous installment of this article, published in October MACHINERY, the development of wheels to meet the requirements of cemented-carbide tool grinding was reviewed and rules were given for grinding with vitrified wheels. This was followed by a review of the development of diamond wheels for carbide tool grinding, together with an outline of the advantages gained by the use of these wheels. The present article will give detailed directions for the application of diamond wheels in carbide tool grinding. Two operations only are required in conditioning cemented-carbide tools.

1. Grind the steel portion of the shank under the cemented-carbide tip, using aluminum-oxide vitrified wheels. (See Fig. 1.) The rough clearing of the steel shank may be done on the periphery of the wheel or by the side-grinding method. It is generally conceded, however, that periphery grinding is the better method of removing large quantities of stock quickly.

2. Grind the cemented-carbide tip with a 6-inch cup diamond wheel, using different grades for roughing and for finishing. (See Fig. 2.) Grinding wheel manufacturers will gladly advise the exact grade required.

By using a vitrified wheel for grinding the soft steel and a diamond wheel for grinding the cemented carbide, the most efficient wheel for each material is utilized and the stock is removed more rapidly. A high degree of skill is not required to condition cemented-carbide tools in this manner, and the danger of heat checking and cracking the carbide is entirely eliminated.

The steel part of the shank under the carbide tip can be ground to a clearance angle of from 10 to 15 degrees on the vitrified wheel, which will permit of four or five resharpenings of the carbide tip on the diamond wheel without the necessity of relieving the steel again. (See Fig. 3, at *A–B*.) This is advocated, since small quantities of steel are ground readily on the diamond wheel without causing excessive waste of the wheel. In this manner, it is necessary to relieve the steel only once in four or five reconditionings of the tool, which makes resharpening a one-operation job on the diamond wheel most of the time.

This method can be applied to all types of tools, with the exception of some types of forming tools, in which case it is an absolute necessity to grind both types of material with one wheel. For such service, the carbide-of-silicon vitrified wheel still remains the most efficient means of grinding. This is especially true of the roughing operation. The

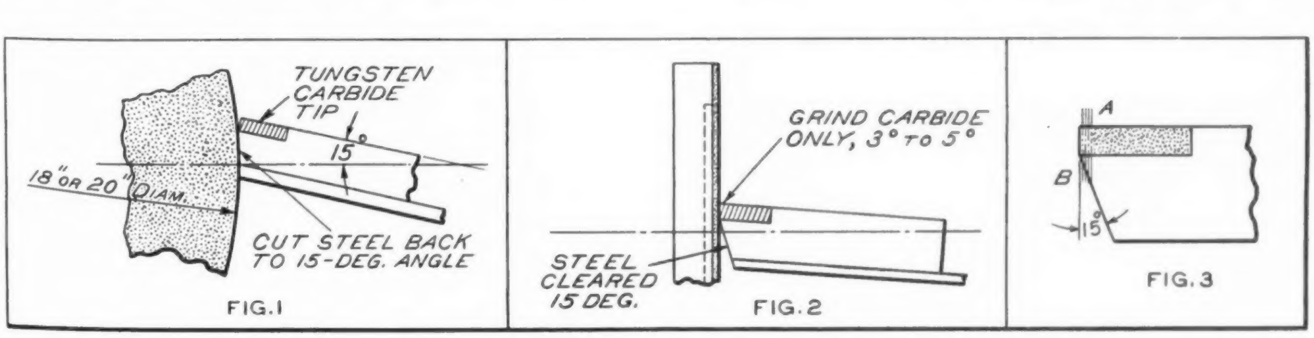


Fig. 1. Using Vitrified Wheel for Offhand Grinding of Steel Shank. Fig. 2. Using Diamond Wheel for Grinding the Tungsten-carbide Tip. Fig. 3. Showing Result of Second to Fifth Regrindings

diamond wheel is not economical on some types of form grinding, because the particular form to be generated is duplicated only occasionally, and it is not economical or practical to reshape the diamond wheel for a variety of forms. The carbide-of-silicon wheel for form grinding has the advantage of being shaped easily with a diamond. Therefore, the forms can be changed without difficulty; and although the wheel wears quite rapidly in grinding, the forms can be maintained by frequent dressing.

There are some forms, however, that are ground more readily with a diamond wheel than with the vitrified wheel. It is easier to hold corners with a diamond wheel or grind radii from the solid; and although it is not possible to hold exactly sharp corners or radii to precision limits using the diamond wheel, the approximate form is obtained more quickly, and there is less lapping to be done to obtain the precision forms after grinding with a diamond wheel than with a vitrified wheel.

Applications for which Diamond Wheel is Especially Useful

The diamond wheel is particularly efficient on the following applications:

Offhand Grinding—The diamond wheel finds its greatest labor-saving application in the reconditioning of single-point tools. In reconditioning single-point tools, such as boring tools, a finish is obtained readily without the necessity for lapping, and the radii are held to close dimensions by the offhand method of application, which also eliminates the necessity for set-ups in form grinding. Large areas and small areas of carbide are ground with equal ease in the shortest possible time without generating localized heat and without requiring a high degree of skill. Labor hours saved in offhand grinding of cemented-carbide tools with a diamond wheel, in every case, have more than offset the initial cost of the wheel.

Surface Grinding—A diamond wheel is of particular advantage in the surface grinding of centerless work-rest blades, since the down feed is generally equivalent to the stock removal, and parallelism of the blade is obtained very readily, owing to the fact that there is little or no wheel wear in the application.

Pure cemented-carbide tips and wear-resistant strips are ground readily with a diamond wheel to geometrically flat surfaces and to very close tolerances.

Inserted-tooth milling cutter blades, which must be made interchangeable, can be ground by one of two methods. The steel portion can be ground with a vitrified wheel, by grinding transversely across the blade; then the tip can be ground separately, using a diamond wheel to bring the carbide down to the body of the steel, and the finishing pass can be taken across the blades in multiple, grinding both the carbide and the steel. Or the blades can be rough-ground to within 0.004 or 0.005 inch of size, using a "Green Grit" vitrified wheel and grinding both the carbide and the steel; then the finishing operation can be done by means of the diamond wheel.

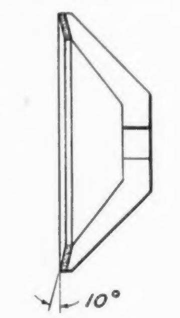


FIG.4

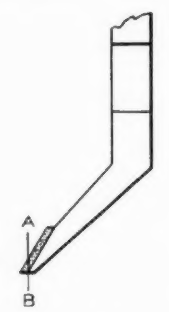


FIG.5

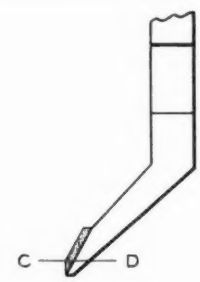


FIG.6

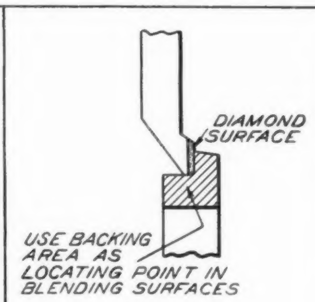


FIG.7

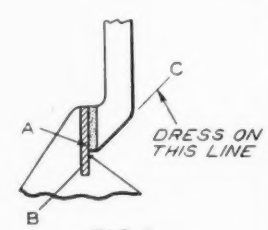


FIG.8

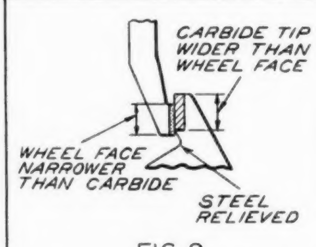


FIG.9

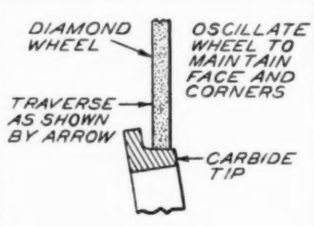


FIG.10

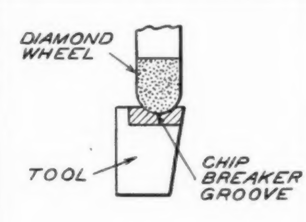


FIG.11

Fig. 4. Concave-face Diamond Wheel Designed for Corner Grinding. Fig. 5. Wheel is Used Until Backing Material Interferes with Cut, as Shown by Line AB. Fig. 6. Wheel is then Dressed on Periphery to Line CD until Diamond Coating Shape is Restored. Fig. 7. Using Diamond Wheel in Grinding a Simple Formed Surface. Fig. 8. If Diamond Surface Wears at Point A, Restore Face by Dressing along Surface BC. Fig. 9. Method of Relieving Tool Shank when Carbide Tip is Wider than Wheel Face. Fig. 10. A Case where Wheel is Fed down next to the Rounded Corner and then Traversed toward the Outer Edge. Fig. 11. Grinding a Chip Breaker Groove in a Carbide Tool with a Diamond Wheel

In using the "Green Grit" vitrified wheel for surfacing mixed metals, light in-feeds should be taken —not to exceed 0.001 or 0.0015 inch per traverse— using a comparatively high table traverse speed and a fairly coarse cross-feed. The economical in-feed, in using diamond wheels, would be about the same as that used for the "Green Grit" vitrified wheels, but the operator would have to be careful, if cross-feeding by hand, to feed at the end of the stroke when the wheel is off the work.

The chief advantages of using the diamond wheel for surface grinding are: (1) The size can be quickly obtained by means of the machine in-feed vernier; (2) the surfaces ground are geometrically flat, so that parallelism can be maintained even on comparatively long pieces of work. All surfacing should be done in multiple for best efficiency.

Tool and Cutter Grinding—A diamond wheel is very efficient on tool and cutter grinding, since there is comparatively no wheel loss in grinding the teeth of a cutter around its entire periphery, regardless of its diameter or the number of teeth. If this operation is done dry, using a diamond wheel, the in-feed should not exceed 0.0015 or 0.002 inch per pass, because greater feeds than this might damage the wheel.

As soon as the cemented-carbide portion of the blade is cleaned up, all the teeth will be within 0.0001 to 0.0002 inch of the same length, which will insure that all the teeth in the cutter will do the same amount of work. The finish on the teeth will be far superior to that obtained by any other means, and the cutters will pass inspection the first time. Labor hours in reconditioning are reduced at least 50 per cent, and possibly more, by this means and tool life is increased from 50 to 100 per cent. A very good finish is generally obtained by the use of a cutter that is finished on diamond wheels.

There are many other applications of the diamond wheel on tool and cutter grinders. On these applications, the wheel is used dry and in-feeds are small, in comparison to wet operation. However, certain types of form grinding are successfully done on a tool and cutter grinder, but these form-grinding operations do not include the application of special face diamond wheels. The form grinding that is done is generally of the type that can be done with 3- or 6-inch saucer wheels.

Cylindrical Grinding—On cylindrical grinding operations, the diamond wheel finds its greatest value in quickly grinding to size to close tolerance. It is also of value in obtaining a higher type of finish on such tools as reamers. Face diamond wheels are used to some extent in cylindrical operations.

Internal Grinding—Internal diamond wheels are used to advantage for bore-grinding small drawing dies that are pure cemented carbide. In grinding holes in tools composed of mixed metals, it is common practice, with the work-head held in a fixed position, to under-cut the steel between the carbide tips by means of a vitrified wheel; the cemented-carbide inserts are then ground to size with a diamond wheel. Some shops have found that it means a saving in labor hours if mixed metals are ground internally to size with a diamond wheel.

Summary of Advantages of Diamond Wheels for Grinding Carbide Tools

Summarizing the foregoing, the diamond wheel is particularly advantageous for the following reasons:

1. A high degree of skill is not required to finish cemented-carbide tools.
2. The cemented carbides cannot be damaged by the use of a diamond wheel.
3. A high cutting rate is obtained, together with a very small wheel loss.
4. Geometrically flat surfaces and true angles are obtained.
5. Labor hours saved more than offset the initial cost of the diamond wheel.
6. Small quantities of carbide are removed per grind.
7. The in-feed is equal to the stock removal; therefore, the size can be obtained quickly through the machine verniers.
8. Parallelism can be obtained quickly due to the absence of wheel wear.
9. The wheel is always in balance and cannot be dressed; therefore, loose abrasive cannot get into the machine bearings.
10. Owing to the free-cutting qualities, the wheel pressures do not squeeze the oil film from the bearings.
11. Machine maintenance costs are reduced.

Figs. 4 to 11 show graphically the application of diamond wheels in general, together with the method of dressing the wheel to maintain the corners and face.

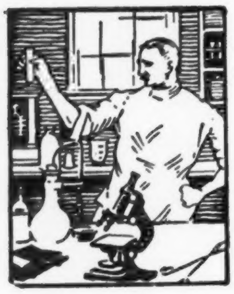
* * *

The 1938 Leipzig Machine Tool Fair

The demand for space in the machine tool section of the Leipzig Fair, to be held March 6 to 14, 1938, at Leipzig Germany, has already exhausted all the available space in the machine tool exhibition building known as Hall 9. In the past, this has been the only building available for machine tools. It has therefore been decided to utilize the building known as Hall 14, in addition to Hall 9, exclusively for machine tools and shop equipment.

A section of this hall will be devoted solely to the products of countries outside of Germany. This hall has two floors, with a total exhibition space of 47,500 square feet. So far, fifty firms have booked space in this hall, among these being Austrian, Swedish, and Swiss machine tool builders. Exhibitors are granted substantial reductions in freight charges. Further information can be obtained from the Leipzig Trade Fair, Inc., 10 E. 40th St., New York City.

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

Galvanized Sheets that Withstand Severe Drawing and Forming

Galvanized sheets of iron and steel with a heavy coating of commercially pure zinc that will not crack or peel during relatively severe drawing or forming operations have been placed on the market by the American Rolling Mill Co., Middletown, Ohio. This new material, which is known as Zincgrip, is available in both sheets and coils. It has from 50 to 75 per cent more protective zinc than the "tight coat" sheets generally used in making fabricated products. Zincgrip sheets and strips from No. 16 to 28 gage are available in any of the basic grades of galvanized iron or steel manufactured by the company.

Zincgrip has been used for more than a year in the production of spiral corrugated lock-seam drainage pipe, and its success in this application is said to point to new fields of use for galvanized materials. According to experiments, Zincgrip sheets are well suited for roof drainage parts, as well as shapes and stampings made by cold-drawing and rolling processes. Refrigerator water-shed pans are being successfully drawn to a depth of 5 inches with the zinc coating intact. The illustration shows a considerable range of parts that have been produced from Zincgrip. 101

Typical Parts Drawn and Formed from Zincgrip Galvanized Iron and Steel

Precolored Metal Sheets that can be Stamped and Formed

Tint-Metal is the name given by the American Nickeloid Co., Peru, Ill., to a line of metal sheets that are prefinished in attractive colors for use in the manufacture of toys, buttons, advertising novelties, decorative panels, molding, window-trim, and various other products that are stamped and shaped. The finish of these sheets is not marred in manufacturing operations, if ordinary care is taken in handling the sheets, and therefore, subsequent painting, lacquering, enameling, baking, or other finishing operations are not required.

Tint-Metal sheets can be obtained in sizes up to 36 by 96 inches and in all gages. Base metals of copper-zinc, copper-steel and copper-tin are available in yellow, red, blue, and green. The sheets can be supplied with a bright, satin, or striped finish, and in crimped or scored patterns. 102

Rubber and Bakelite Laminated Used in Ledger Covers

Ledger covers are being made from a combination of rubber and Bakelite Laminated by an English manufacturer. The materials are made up in the form of a sandwich with the sheets of resinoid-impregnated fabric on the outer sides and rubber between. Upon the application of heat and pressure, the rubber is squeezed out at the margins to form a resilient edge of any desired shape. The Bakelite Laminated emerges from the press with a lustrous, highly polished surface.

The basic feature of this combination is that the

To obtain additional information about materials described on this page, see lower part of page 206.

two materials can be molded under the same conditions of temperature, pressure, and time, which makes the resulting product highly resistant to shock. 103

Fast Synthetic Primer for Metal Products

A synthetic primer that air-dries in five minutes and reduces work rejections due to dust and dirt has been developed for use on metal products by the Maas & Waldstein Co., Newark, N. J. This "speed" primer is suitable for use under air-drying lacquer enamels or baking synthetic enamels, and also as a shop coat. In addition, it can be force-dried or baked under a flexible schedule ranging from two hours at 160 degrees F. to twenty minutes at 275 degrees F. It can be supplied in many colors for either dipping or spraying. 104

Malleable Iron—a Basic Material of Industry

The malleable-iron castings industry, one of the nation's basic industrial activities, has shown a healthy increase during the last four years. In 1936, the production of malleable castings totaled 665,000 tons. Reports for the first half of 1937 show that operations are at 73 per cent of capacity, compared with 57 per cent for the first half of 1936.

In this industry, manufacturing methods have recently been vastly improved and new and modern equipment has been adopted. Perhaps the most typical example of malleable foundry progress is to be found in the improvement of annealing equipment. Ten years ago, the average annealing cycle was from eight to ten days. Today, due to improved equipment, many plants complete their annealing in four days, and a few are provided with equipment that will anneal in from thirty-six to forty-eight hours. Equipment of this kind will doubtless be universally used in the industry within a few years.

In spite of the already great field of applications for malleable castings, new uses are constantly being found. They are used in building a wide variety of products, such as automobiles, ships, airplanes, lamp-posts, office and home equipment, farm and railroad equipment, bridge railings, park bench frames, and agricultural tools.

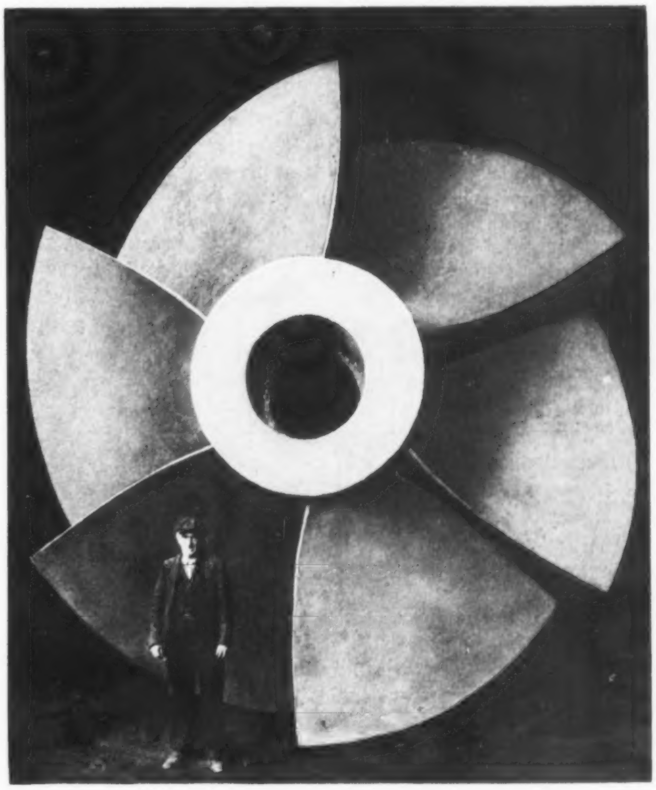
There are two fundamental reasons for the manifold applications of malleable castings—one is their moderate price, and the other, their physical properties—their strength and the fact that they have unusual resistance to shock and vibration. Malleable castings as now produced can be readily machined, are unusually corrosion-resistant, and can be painted, galvanized, or plated.

It is of especial interest to note that in 1936 not less than 56 per cent of the entire output of the malleable industry was used in the automotive field. Approximately 70 pounds of these castings are said to be used in the construction of the average automobile. This wide use of malleable castings in automobile construction, where dependability of materials is so important, indicates how reliable the metal is considered by a class of engineers especially known for their rigid requirements. 105

Hydraulic Turbine Casting that Weighs Fifty-Five Tons

A hydraulic turbine runner that weighed 110,000 pounds as cast and approximately 66,000 pounds finished for installation is shown in the accompanying illustration. The material is a cast alloy steel containing 0.20 per cent carbon and 1 per cent nickel. According to *Nickel Steel Topics*, published by the International Nickel Co., the nickel was added, not only to improve the mechanical properties, but also to avoid foundry difficulties due to the intricate shape of the casting, with its varied sectional dimensions. The nickel content also eliminated the necessity of annealing because it made the casting adequately strong in the "as cast" condition.

This huge casting was produced by the Canadian Car & Foundry Co., Ltd., Montreal, Canada, for the Dominion Engineering Works, of Lachine, Quebec. 106



Huge Hydraulic Turbine Runner Cast from an Alloy Steel Containing 0.20 Per Cent Carbon and 1 Per Cent Nickel

To obtain additional information about materials described on this page, see lower part of page 206.

NEW TRADE LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts and Materials. To Obtain Copies, Check on Form at Bottom of Page 205 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the November Number of MACHINERY

Engine Lathes

R. K. Le Blond Machine Tool Co., Cincinnati, Ohio. Catalogue illustrating and describing in detail the construction of the Le Blond line of lathes, including heavy-duty geared-head engine lathes, tool-room lathes, gap lathes, Regal lathes for lighter work, rapid-production lathes, multi-cut lathes, automatic lathes, crankshaft lathes, etc. 1

Carbide Tips and Tools

Firth-Sterling Steel Co., McKeesport, Pa. Folder showing many different standard Firthite tip designs, as well as many standard Firthite tools. Information is also given on the recommended symbols used in specifying angles, rakes, clearances, radius, right- and left-hand single-pointed tools, etc. New low prices are included. 2

Production Control Instruments

National Acme Co., 123 E. 131st St., Cleveland, Ohio. Bulletin 3707, containing complete information on three new models of Chronologs for recording productive and idle time of machines and equipment, and counting the number of pieces on a job. The bulletin also describes a new line of supersensitive line voltage switches and Namco solenoids. 3

Motor Reconditioning Equipment

Ideal Commutator Dresser Co., 1011 Park Ave., Sycamore, Ill. Folder illustrating and describing the company's products, including commutator and slip-ring resurfacers, precision grinders, commutator turning tools, mica under-cutters, thermo grip pliers, and other appliances for motor maintenance. 4

Thrustor Control

General Electric Co., Schenectady, N. Y. Circular GEA-1569A, illustrating and describing thrustor-operated valves for pipe sizes from 1 inch to 10 inches. Bulletin GEA-1518, descriptive of shoe type thrustor brakes for alternating-current motors, adapted for severe service on mills, cranes, hoists, etc. 5

Automatic Lathes

Lodge & Shipley Machine Tool Co., Cincinnati, Ohio. Folder entitled "Duomatic Production—More Minutes Per Hour," showing set-ups on a variety of jobs and giving actual results obtained by Duomatic lathes, which are made in three sizes to cover the entire range of automatic lathe work. 6

Hard-Facing

The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 205 E. 42nd St., New York City. Folder entitled "Steel Hard-Facing Procedure," giving detailed instructions for applying the hard-facing material Haynes Stellite to steel wearing surfaces by the oxy-acetylene welding process. 7

Vapor Spray Cleaners

Homestead Valve Mfg. Co., Inc., Coraopolis, Pa. Folder entitled "Watch that First Step Mr. Car Dealer," descriptive of the "Hypressure Jenny" steam vapor spray cleaning machine and its application for cleaning machinery, buildings, automobiles, and all other cleaning purposes. 8

Welding and Cutting Equipment

The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 205 E. 42nd St., New York City. Booklet entitled "Preventing Welding and Cutting Fires," giving rules to follow in order to prevent fires from being started by the use of oxy-acetylene welding and cutting equipment. 9

Grinding Machines

Landis Tool Co., Waynesboro, Pa. Catalogue K-137, illustrating and describing in detail the Landis 12- by 28-inch universal and tool grinder. A number of typical operations performed with standard equipment are illustrated, and examples of the use of additional equipment are shown. 10

Ground Steel Pins and Bushings

Ex-Cell-O Corporation, 1200 Oakman Blvd., Detroit, Mich. Catalogue RR-437, containing complete data on Ex-Cell-O hardened and ground steel pins and bushings for locomotive driver brakes, spring rigging, and frames. 11

Welding News

James F. Lincoln Arc Welding Foundation, Cleveland, Ohio, is distributing a publication entitled "Arc Welding Foundation News," containing detailed information regarding the Award Program of the Foundation, offering $200,000 for papers on arc welding. 12

Laminated Brass Shims

Laminated Shim Co., Inc., 21-66 Forty-Fourth Ave., Long Island City, N. Y., has issued a convenient specifications file folder containing detailed data on laminated brass shim stock (Laminum), covering materials, composition, stock sizes, etc. 13

Speed Reducers and Gears

D. O. James Mfg. Co., 1120 W. Monroe St., Chicago, Ill. Circular entitled "It's Gotta be Right Every Time," illustrating the inspection and checking of gears in this company's plant, as well as typical speed reducers made by the concern. 14

Insulated Electrode-Holders

Jackson Electrode Holder Co., 6553 Woodward Ave., Detroit, Mich. Leaflet descriptive of the Jackson insulated electrode-holder, designed to provide safety for the welder and avoid the spoiling of work by burning. 15

Grinding Machines

NORTON Co., Worcester, Mass. Circular illustrating eight different applications of the Norton multi-purpose hydraulic universal grinder, showing the versatility of this machine both for production work and odd jobs. 16

Cast Iron for Machinery Parts

INTERNATIONAL NICKEL Co., INC., 67 Wall St., New York City. Booklet entitled "Cast Camshafts and Crankshafts Possess Many Advantages," giving detailed information about highly stressed machinery parts for which alloy cast irons are used. 17

Welding Equipment

LINCOLN ELECTRIC Co., Cleveland, Ohio. Application Sheet No. 57 in a series on machine design, showing miscellaneous machine parts constructed by the welding process, and pointing out the specific savings effected by welded steel design. 18

Gear-Cutting

NATIONAL BROACH & MACHINE Co., Shoemaker and St. Jean Sts., Detroit, Mich. Manual entitled "Modern Methods of Gear Manufacture," available for distribution to executives and engineers interested in gear production. 19

Oil-Impregnated Bearings

MORAINE PRODUCTS DIVISION, GENERAL MOTORS CORPORATION, Dayton, Ohio. Handbook of Durex bearings, which are made of a special bronze alloy having the ability to absorb lubricating oil and feed it to the rubbing surface. 20

Heat-Treating Equipment

LEEDS & NORTHRUP Co., 4921 Stenton Ave., Philadelphia, Pa. Circular covering the Leeds & Northrup complete line of Vapocarb-Hump and Homo furnaces for hardening, tempering, and nitriding tools, dies, and production parts. 21

Corrosion-Resistant Lacquers

ROXALIN FLEXIBLE LACQUER Co., INC., Elizabeth, N. J. Bulletins covering Blue Knight Roxyn C chemical-resistant flexible lacquer, and cadmium water-dip lacquer No. 3850, with high resistance to spots and tarnish. 22

Broaching

NATIONAL BROACH & MACHINE Co., Shoemaker and St. Jean Sts., Detroit, Mich. Circular entitled "Broaching," calling attention to the surface tools and broach steel that the company is in a position to furnish. 23

Motor-Driven Pumping Units

FAIRBANKS, MORSE & Co., 900 S. Wabash Ave., Chicago, Ill. Bulletin 5592, illustrating and describing Fairbanks-Morse two-stage "built-together" pumps, mounted on the shafts of "splash-proof" motors. 24

Carboloy-Tipped Tools

CARBOLOY COMPANY, INC., 2987 E. Jefferson Ave., Detroit, Mich. Illustrated booklet T-37, describing in detail a process by which Carboloy users can make Carboloy-tipped tools in their own plants. 25

Lighting Equipment

FOSTORIA PRESSED STEEL CORPORATION, Fostoria, Ohio. Handbook ML6, on localized lighting for industrial needs, descriptive of Fostoria complete lighting units, supporting arms, reflector assemblies, etc. 26

Mica Insulating Material

CONTINENTAL-DIAMOND FIBRE Co., Newark, Del. Catalogue describing the properties and applications of Micabond, a bonded mica insulating material, supplied in the form of sheets, tubes, and rings. 27

Arc-Welding Machines

HOBART BROS., Hobart Square, Troy, Ohio. Folder telling how to build a portable arc-welding machine, using the Hobart new 40-volt arc-welding generator known as the "Build Your Own" unit. 28

Milling Cutters

LOVEJOY TOOL Co., INC., Springfield, Vt. Catalogue 25, entitled "Meeting Milling Cutter Requirements," containing complete data on Lovejoy positively locked, inserted-tooth milling cutters. 29

To Obtain Copies of New Trade Literature

listed on pages 204-206 (without charge or obligation) mark with X in squares below, the publications wanted, using the identifying numbers at the end of each descriptive paragraph; detach and mail to:

MACHINERY, 148 Lafayette St., New York, N. Y.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	

Name .... *Position or Title* ....

[This service is for those in charge of shop or engineering work]

Firm ....

Business Address ....

City .... *State* ....

[SEE OTHER SIDE]

Diesel Generating Sets

FAIRBANKS, MORSE & Co., 900 S. Wabash Ave., Chicago, Ill. Bulletin 3600-A2, illustrating and describing the construction and application of Fairbanks-Morse Model 36-A Diesel generating sets. 30

Indicating Pyrometers

WHEELCO INSTRUMENTS Co., 1929 S. Halsted St., Chicago, Ill. Bulletin 503, illustrating and describing Wheelco high-resistance indicating pyrometers and combination pyrometers and switches. 31

Bearing Bronze

CONSOLIDATED METALS CORPORATION, 5531 Woodward Ave., Detroit, Mich. Circular listing the dimensions and weights of Motex bearing bronze, supplied in the form of cored and solid bars. 32

Inserted-Tooth Saws

PITTSBURGH TOOL-KNIFE & MFG. Co., Pittsburgh, Pa. Catalogue covering inserted-tooth saws made by this concern in eight different tooth sizes. Dimensions and list prices are included. 33

Lighting Equipment

WESTINGHOUSE ELECTRIC & MFG. Co., Lighting Division, Cleveland, Ohio. Catalogue Section 61-166, describing the Millite lighting unit for extreme service conditions in industrial plants. 34

Electric Equipment

GENERAL ELECTRIC Co., Schenectady, N. Y. Bulletin GEA-2577, on the size 00 alternating-current contactor, a magnetic switch for relaying control circuits and for controlling small motors. 35

Potentiometer Pyrometers

BROWN INSTRUMENT Co., 4485 Wayne Ave., Philadelphia, Pa. Catalogue 1102, covering the complete line of Brown indicating, recording, and controlling potentiometer pyrometers. 36

Air Valves

W. H. NICHOLSON & Co., 12 Oregon St., Wilkesbarre, Pa. Circular illustrating and describing three- and four-way type air valves for pressures up to 125 pounds per square inch. 37

Spot-Welders

FEDERAL MACHINE & WELDER Co., Warren, Ohio. Bulletins 501 and 502, describing, respectively, foot-operated spot-welding machines and automatic motor-driven spot-welding machines. 38

Blowers

JANETTE MFG. Co., 556-558 W. Monroe St., Chicago, Ill. Bulletin 24-27, entitled "Blower Wheels," giving tables of dimensions and capacities at various static pressures. 39

Non-Metallic Motor Pinions

BOSTON GEAR WORKS, INC., North Quincy, Mass. Folder D-1 on non-metallic motor pinion drives, listing twenty-five new sizes of Boston non-metallic motor pinions. 40

Lifting Magnets

OHIO ELECTRIC MFG. Co., 5900 Maurice Ave., Cleveland, Ohio. Bulletin 110, descriptive of the company's improved lifting magnets and magnetic controllers. 41

Lifting Jacks

DUFF-NORTON MFG. Co., Pittsburgh, Pa. Catalogue describing the company's complete line of lifting jacks for industrial, railroad, and mine use. 42

Variable-Speed Control

COLUMBIA VARI-SPEED Co., Wheaton, Ill. Circular on the JFS-Jr. Vari-speed control, applicable to old or new equipment requiring variable speed. 43

Centrifugal Pumps

LOGANSPORT MACHINE, INC., Logansport, Ind. Bulletin 60-A, on Logan "Sure Flow" centrifugal pumps for pumping coolant, oil, etc. 44

Machine Shop Heating

DRAVO CORPORATION, Pittsburgh, Pa. Catalogue describing Lee direct-fired unit heaters for industrial applications. 45

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described on pages 207-224 is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment mark with X in the squares below, the identifying number found at the end of each description on pages 207-224—or write directly to the manufacturer, mentioning machine as described in November MACHINERY.

51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71
72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92

Fill in your name and address on other side of this blank.

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on pages 202-203 mark with X in the squares below, the identifying number found at end of each description on pages 202-203—or write directly to the manufacturer, mentioning name of material as described in November MACHINERY.

101	102	103	104	105	106

Fill in your name and address on other side of this blank.

Detach and mail to MACHINERY, 148 Lafayette St., New York, N. Y.

[SEE OTHER SIDE]

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Newton Planer- and Drum-Type Machines for Drilling, Boring and Milling Operations

A planer type machine designed for precision drilling and boring operations on large printing press frames, stacks of frames, or large castings where numerous holes must be accurately located, drilled, and bored, has recently been built by the Newton Division of the Consolidated Machine Tool Corporation, Rochester, N. Y. This machine, which is illustrated in Fig. 1, is to be used principally in boring holes for mounting Timken precision bearings and similar work requiring a high degree of accuracy.

Both boring heads and the table are provided with handwheels for precision positioning, and they are equipped with end measures, inside micrometers, and dial indicators. The boring-bars are provided with a power rapid traverse vertically, and the heads have a rapid traverse across the rail. Power feed and traverse are provided for the rail and tables. Operation of the machine is facilitated by large dials, which can be read easily from the floor. A dial on each head indicates directly, in revolutions per minute, the speed of the spindle, and dials on each gear-box show the feed per revolution.

The boring-bars are double-splined to fit the driving gears, which have extended hubs mounted in Timken bearings. Each bar has an additional bearing ring in a slide with roller thrust collars for taking the cutting thrust. The right-hand head is operated from the gear-box at the right-hand end of the rail, and the left-hand head from the gear-box at the corresponding end of the rail.

The table is built in two sections, which can be coupled together or used separately, so that one can be loaded while the other is in use. The tables are mounted on one vee and one flat way, and continuous feed for the

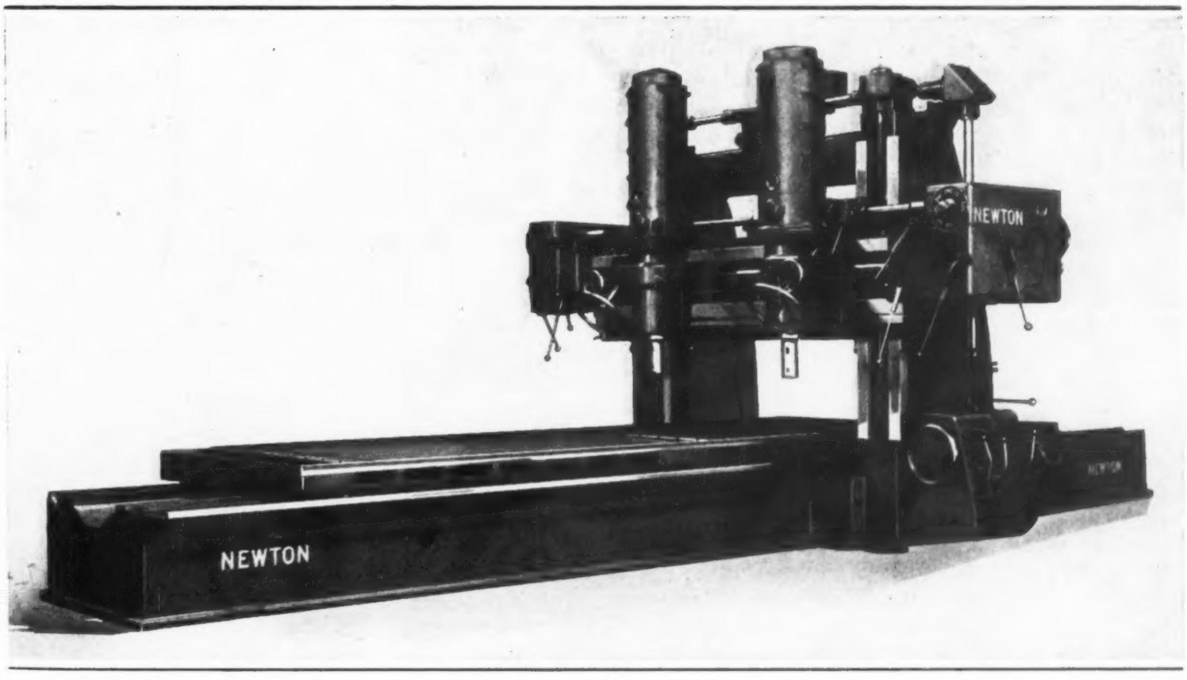


Fig. 1. Newton Planer Type Machine for Accurately Locating, Drilling, and Boring Holes in Large Work

To obtain additional information on equipment described on this page, see lower part of page 206.

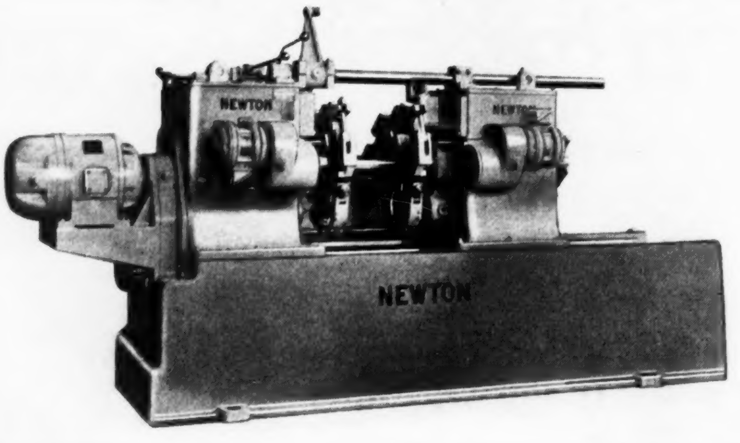


Fig. 2. Newton Drum Type Machine for Face-milling and Center-drilling the Ends of Shafts

combined length is provided through an angular rack under each table. The tables are also equipped with milling feeds obtained through a worm and rack drive, to provide for milling the sides of castings in case a side unit milling head is desired.

Two adjustable-speed motors are required for driving the heads and the rail, and one constant-speed motor is required for driving the table. A small motor is provided for rapid traverse of the rail. The two rail gear-boxes are lubricated by a self-contained pump, and the table gear-box is splash-lubricated. The bed ways are lubricated by a forced-feed system from a small motor and pump. All other points requiring lubrication are served by a central one-shot system. Machines of this design can be built in a range of sizes to meet specific requirements.

A drum type machine built by the same concern for simultaneously face-milling and center-drilling both ends of shafts is illustrated in Fig. 2. This machine is equipped with a three-station universal fixture, arranged to dwell against index-pins during drilling and loading.

After the work has been loaded at the front of the machine, the operator moves a lever that causes reversal of the drill spindles that have just finished center-drilling in the third station of the machine. These spindles then back out to clear the work, after which the operator releases the index-pins and starts the drum in a rapid approach movement which changes automatically to a feed movement for milling both ends of the shaft.

After the milling cuts have been completed, the drum again changes to a rapid traverse and stops against the index-pins. The operator next moves a lever to start feeding the center drills to the work. While the ends of the shaft are being milled and center-drilled, the operator unloads the finished work and loads a new piece. Upon the completion of the center-drilling operation, the cycle is repeated.

The two milling spindles run in Timken roller bearings and are supported by sleeves that have a separate adjustment for setting the cutters to the desired depth. One of the heads in which the milling spindles are mounted is bolted in a stationary position, while the other head is adjustable along the base. Both heads are driven from one motor and connected through reduction gears which run in oil.

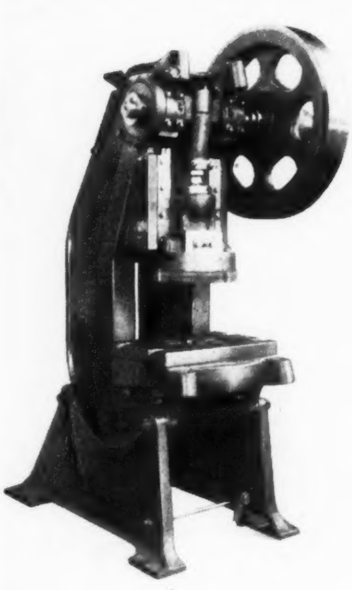
Each of the opposing drill spindles has a separate motor drive through reduction gears, including pick-off gears for changing the spindle speed. The drill spindles are also mounted in Timken roller bearings. The drilling feed is hydraulically actuated, each drill spindle being mounted in a sleeve which is operated horizontally by hydraulic pressure developed in a small cylinder mounted on the drill heads.

In addition to the milling and drilling spindles, each head contains a spindle for driving the work-holding fixture. The drum is also hydraulically actuated, thus giving a wide range of easily adjustable feed rates. 51

Marquette Pneumatic Cushion for Press Slides

The Marquette Tool & Mfg. Co., 1420 Hastings St., Toledo, Ohio, a Division of the E. W. Bliss Co., is announcing a compact pneumatic cushion for attachment under the slide of power presses, as shown in the illustration. This cushion can be used in conjunction with Calleson blanking, drawing, and curling dies instead of springs or rubber cushions. It is equally suited to stripping and blank-holding operations.

When this cushion is used with Calleson dies, the cushion and draw-ring come down together to blank and draw the



Marquette Pneumatic Cushion Attached to Press Slide

To obtain additional information on equipment described on this page, see lower part of page 206.

shell. The upper draw-ring then recedes while the lower forming die pushes upward to form the edge curl against the pressure of the slide cushion. When the edge has been completely curled, the slide cushion recedes with the upper draw-ring, and the lower forming die ejects the shell. The stroke of the slide cushion must be the same as the length of the edge curl.

When the cushion is used as a stripper, the stripper plate can be easily slid back out of the way to facilitate the setting of dies, by merely releasing the air from the cushion. Stripping is controlled in a positive manner.

The use of this slide cushion in combination with the regular cushions in the bed enables a single-action press to be converted into a triple-action press. The cushion is made in various sizes. 52

Landis Chaser Grinding Machines

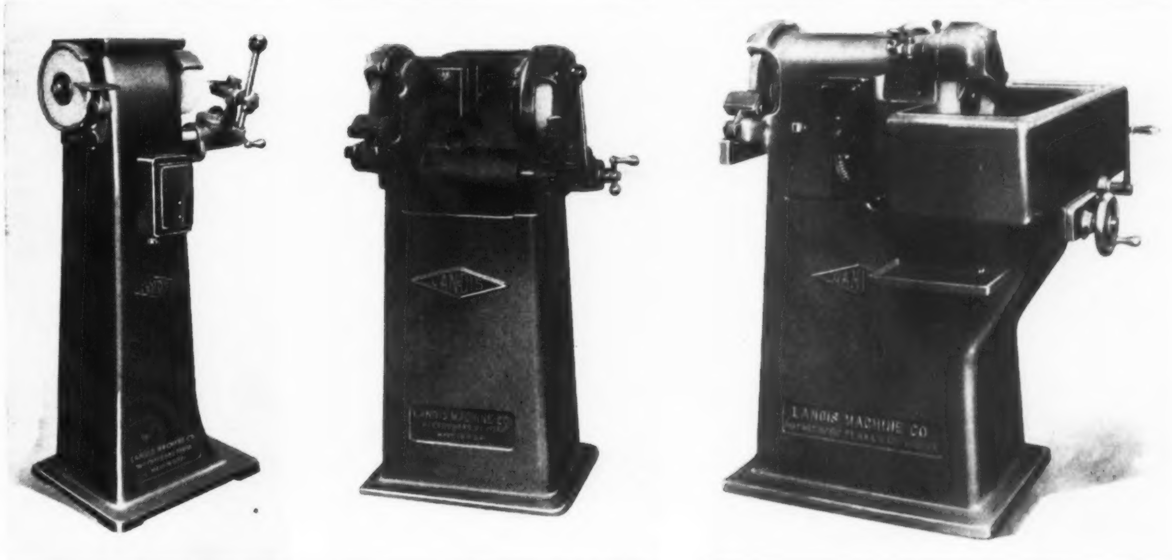
Three chaser grinders of new design have been brought out by the Landis Machine Co., Inc., Waynesboro, Pa., to replace the previous Model Y and No. 2 grinders. The three new models cover the entire size range of Landis chasers. The grinding wheels are mounted directly on the armature shaft of the driving motor, thus eliminating the need for employing gear or chain drives.

Two grinding wheels, one of the cup type and the other straight, are supplied as standard equipment. The grade, grain, and size of the wheels have been selected to insure long life and efficient grinding. The straight wheel is used for grinding rake angles on bolt chasers to be used for cutting threads without the use of a lead-screw. A rest that is adjustable to any angle facilitates this rake-grinding operation. The straight wheel can also be used for miscellaneous grinding. The cup-wheel is used for grinding the lead and rake angles of all pipe chasers and bolt chasers when the thread is to be cut with a lead-screw controlling the operation.

The Model 0 machine, shown in Fig. 1, is designed for grinding chasers for the smaller sizes of die-heads. This grinder is especially suitable for use directly in production departments where a number of die-heads are employed, so as to save time lost in carrying chasers to and from a centralized grinding department.

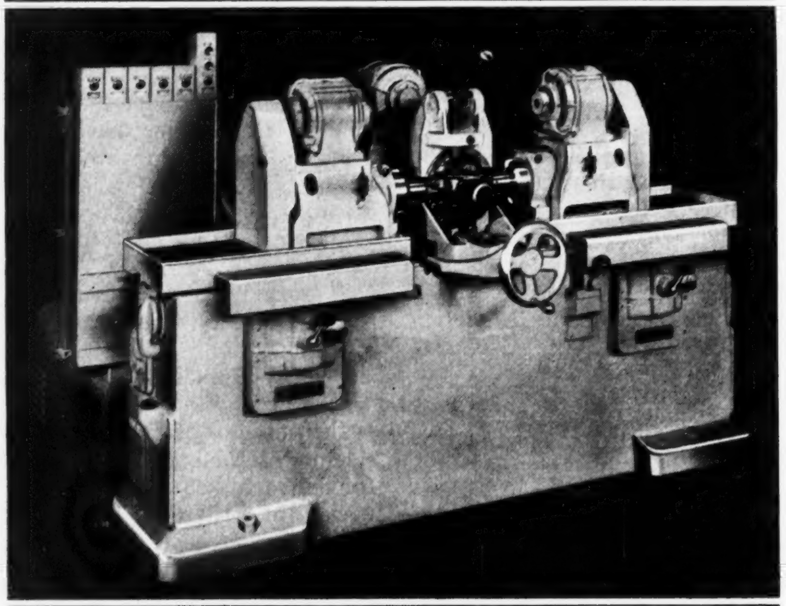
The No. 1 grinder, shown in Fig. 2, is a heavier machine intended for grinding all chasers up to 1 7/8 inches wide. This machine is suitable for use in tool-rooms for the production grinding of chasers. The No. 1 1/2 grinder, illustrated in Fig. 3, is an extra heavy-duty machine designed for grinding the largest Landis chasers under severe production conditions. It is the only one of the three models in which means are provided for delivering coolant to the cup-wheel, in order to reduce the generation of heat. This grinder is also the only one of the three provided with a traversing table on the cup-wheel end of the machine.

On the Models 0 and No. 1, the chaser being ground is gripped in a swivel head which is mounted on a cylindrical base. The cylindrical base operates on a spindle, and is fitted with a long handle which is used to swing it in an arc parallel to the wheel. A feed-screw is provided through the spindle to in-feed or withdraw the swivel head. An adjustable stop limits the length of travel of the swivel head parallel to the wheel. 53



Figs. 1, 2, and 3. Three Machines Brought out by the Landis Machine Co. for Grinding Thread Chasers

To obtain additional information on equipment described on this page, see lower part of page 206.



Ex-Cell-O Three-way Multiple Precision Boring Machine

Ex-Cell-O Multiple Precision Boring Machines

A new line of high-speed multiple boring, facing, and turning machines designed for high production is being built by the Ex-Cell-O Corporation, Detroit, Mich. This line comprises both two- and three-way types, with from two to nine boring spindles.

These machines can be equipped for boring, turning, or facing from more than one direction without relocating the work. Parts requiring operations from one side only can be held in multiple fixtures, thus increasing the production rate. Complete boring and facing in one set-up of such parts as differential carriers, for example, is accomplished in a total cutting time of approximately thirty-seven seconds.

Three-way machines, like the one illustrated, have the boring spindles and individual motor drives separately mounted on sliding tables. Hydraulic table feeds are employed, with individual hydraulic pumps for each table. The operating cycles are completely automatic, each table being provided with micrometer adjustment dogs for controlling the distance for fast approach, cutting, dwell, and fast return. The dwell period at the end of the cutting stroke is separately adjustable from one to thirty seconds, to insure the desired finish. Spindle speeds that give a cutting speed of about 400 feet per minute are provided for carbide cutting tools. For high-speed steel cutting tools, lower spindle speeds are provided. The feeds can be varied from 0 to 42 inches per minute.

Individual starting controls of the push-button type control the electric motors that operate the spindles and pumps. Two additional buttons permit simultaneous starting and stopping of all motors. Each table has a separate lever control, and there is a single lever that permits all three tables to be started and stopped simultaneously. The machine illustrated is equipped for dry cutting, but has a sump in the base which permits the installation of a coolant system. Provision is made for driving the coolant pump from one of the hydraulic pump control units.

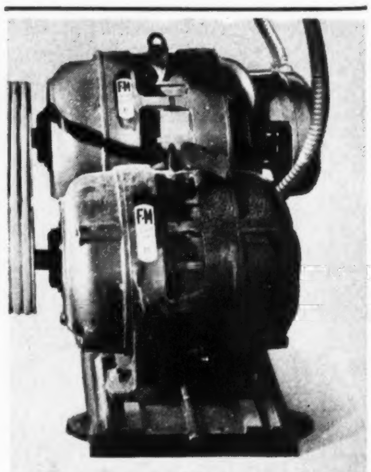
The spindles are universally adjustable—vertically, axially, and transversely. Holes from 3/8 inch up to 6 inches in diameter can be bored. The maximum table travel is 12 inches.

The two-way machines of this line are particularly adapted for machining such parts as differential carriers, transmission cases, cylinder bores, connecting-rods, pistons, pump bodies, etc. 54

Fairbanks-Morse Frequency Changer

A frequency changer that permits increasing and varying the spindle speeds of a machine to satisfy different production requirements has been built by Fairbanks, Morse & Co., 900 S. Wabash Ave., Chicago, Ill. The wiring lay-out is such that the all-electric-driven machine can be operated directly from the line with a frequency of 60 cycles or through the frequency changer at higher frequencies.

The frequency changer consists of a 25-horsepower, three-phase, 60-cycle, 220-volt motor having a speed of 1800 revolutions per minute which drives another motor of the slip-ring type having a speed of 1800 revolutions per minute. This equipment has an output of 33 kilowatts. Through the use of a V-belt drive with interchangeable sheaves on the driving motor, frequencies of 100, 120, and 150 cycles can be obtained. These frequencies give spindle speeds of 6000, 7200, and 9000 revolutions per minute. 55



Fairbanks-Morse Frequency Changer for Varying Motor Speeds

To obtain additional information on equipment described on this page, see lower part of page 206.

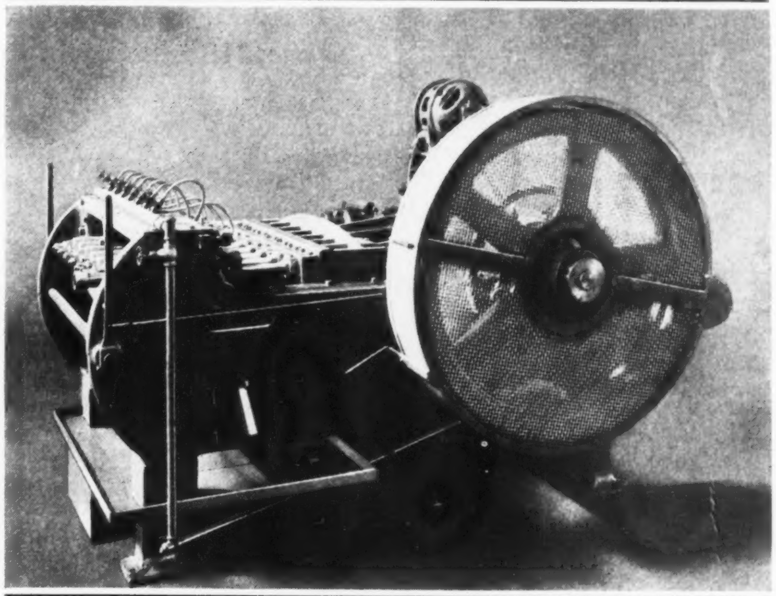


Fig. 1. Multiple-station Press for Performing Operations Indicated in Fig. 2

Waterbury-Farrel Multiple-Station Horizontal Drawing Press

A horizontal type of drawing press with a multiple number of stations has been developed by the Waterbury Farrel Foundry & Machine Co., Waterbury, Conn., to take advantage of the fact that most metals withstand more drawing without annealing when worked continuously than when the drawing operations are interrupted, so that the metal cools between the operations.

The press shown in Fig. 1 has seven stations. Fig. 2 shows the sequence of operations performed by this press in drawing a brass shell 11/16 inch in diameter by 4 1/2 inches long from a cup 1 1/4 inches in diameter by 1 1/2 inches deep. The stroke of the machine is 11 inches, and the production fifty pieces per minute.

The cup from which this shell is drawn is produced from a blank 0.022 inch thick by 3 1/8 inches in diameter. After the blanking and cupping operations, the pieces are annealed and redrawn, if necessary, and then fed to the seven-station horizontal press, where they are completed without interruption. An oscillating bar type of transfer device equipped with a series of spring fingers carries the shells successively from station to station. Each station is provided with a spring knock-out. After the last draw, the shells are clipped and pushed through the die.

The advantages claimed for this multiple-station press include deep drawing without loss of time for intermediate annealing and the elimination of lost time in changing coils of metal. Besides these advantages, the dies cannot become filled with lubricant, defective work falls out of the dies without jamming, and there is no necessity for providing a counterbalance for the gate.

The press illustrated can be furnished to operate at strokes from 6 to 11 inches, inclusive, for the production of shells from 2 1/2 to 4 1/2 inches in length. The feed chute accommodates shells up to 2 inches in diameter. 56

Federal Test Indicator

A test indicator graduated to 0.001 inch and having a range of 0.030 inch has been added to the line of precision measuring instruments manufactured by the

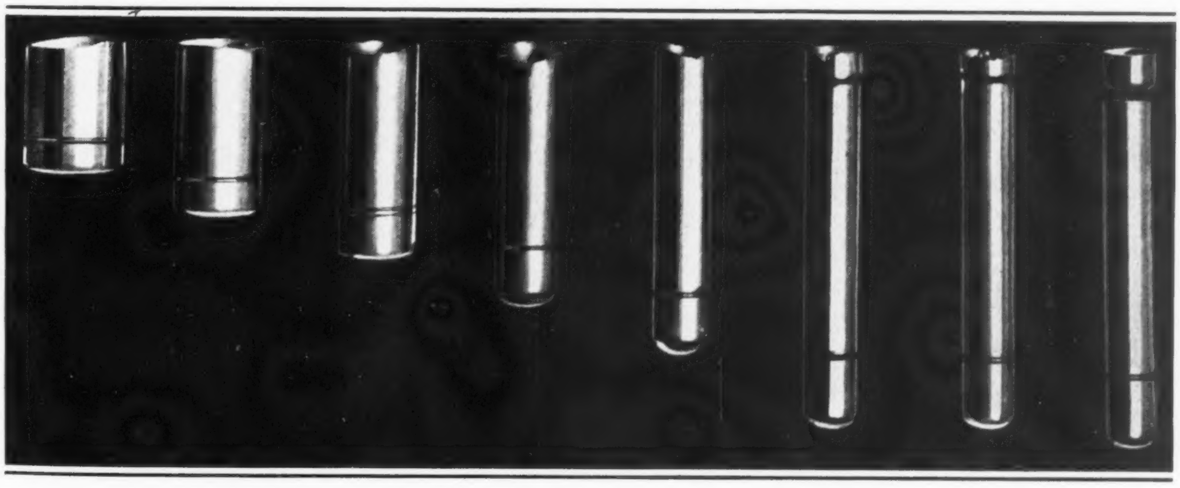


Fig. 2. Sequence of Operations Performed by the Horizontal Press Shown in Fig. 1

To obtain additional information on equipment described on this page, see lower part of page 206.

Federal Products Corporation, 1144 Eddy St., Providence, R. I. This new instrument is known as the Model One and is similar to the Model Two indicator described in July MACHINERY, page 764-C, which has 0.0001-inch graduations.

The same type of instrument can also be furnished with metric graduations. The indicator known as the Model Three is graduated to 0.005 millimeter and has a total range of 0.2 millimeter, while an indicator known as the Model Four is graduated to 0.01 millimeter and has a total range of 0.8 millimeter. All of these instruments have the same dial and are practically the same in appearance. 57

Clark Floor Type Grinders

Floor type grinders of three and five horsepower, adapted for either production work or general tool grinding, have recently been added to the line manufactured by the James Clark, Jr., Electric Co., Louisville, Ky. These machines have been designed with a view to making the grinding wheels as accessible to the operator as possible and yet protecting him from injury. Safety devices furnished as standard equipment include a hood that is adjustable for wheel wear and shatter-proof glass shields. The rotor shaft is mounted in heavy-duty, grease-lubricated ball bearings, and the motor is totally enclosed.

The three-horsepower grinder is designed for continuous duty at 1750 revolutions per minute. The grinding wheels are 14 by 2 by 1 1/4 inches in size, and the distance between wheel centers is 28 inches. This machine is of the same general appearance as the two-horsepower grinder made by the same concern which was described in November, 1936, MACHINERY, page 227.

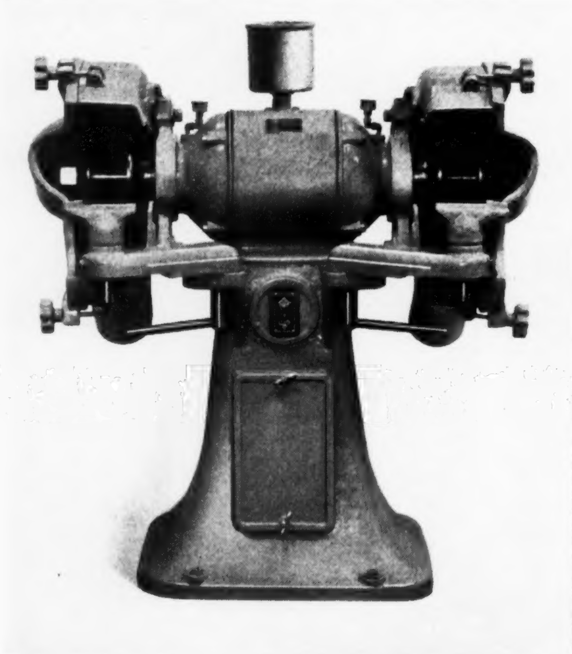
The five-horsepower grinder is adapted especially for all classes of heavy production grinding in machine shops and foundries. The wheels are 18 by 3 by 1 3/4 inches, spaced 31 inches between centers. 58

Producto-Matic Knee Type Milling Machine

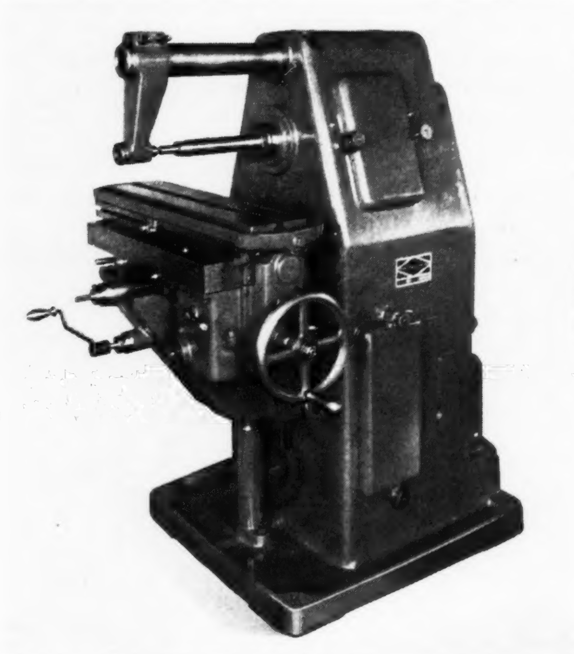
A light simplified milling machine of the knee-and-column type with a power feed to the table has been added to the line of the Producto Machine Co., Bridgeport, Conn. This machine is intended especially for use in manufacturing typewriters, sewing machines, business machines, small textile parts, electrical appliances, and other work handled most economically on light equipment of wide adaptability.

The one-piece column encloses the motor, oil-pump, oil reservoir, and complete transmission for obtaining the spindle speeds and table feeds. V-belts and pulleys provide twelve spindle speeds and six table feeds. All pulleys and shafts in the transmission are equipped with anti-friction bearings and run in oil; the cutter-spindle rotates in two Timken roller bearings.

The machine accommodates standard attachments and tools, including a vertical milling attachment, 5-inch swivel vise, 6-inch universal index-centers, end-mill adapters, and cutter-arbors. 59

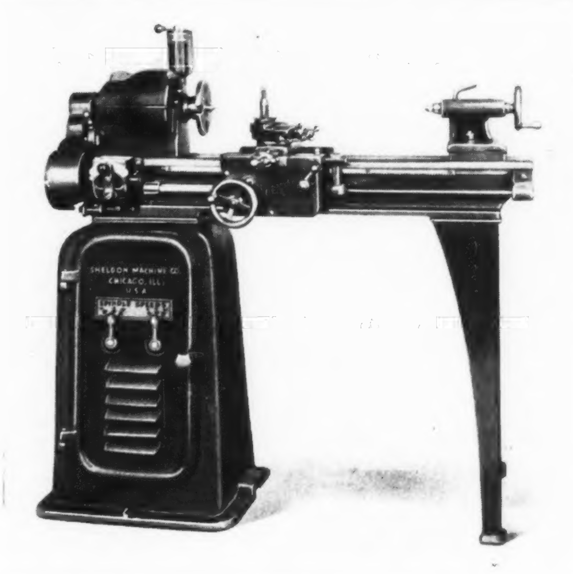


Five-horsepower Floor Type Grinder Built by the James Clark, Jr., Electric Co.



Producto-Matic Milling Machine of Light, Simplified Construction

To obtain additional information on equipment described on this page, see lower part of page 206.



Sheldon Lathe with a Motor Driving Unit Enclosed in the Cabinet Leg

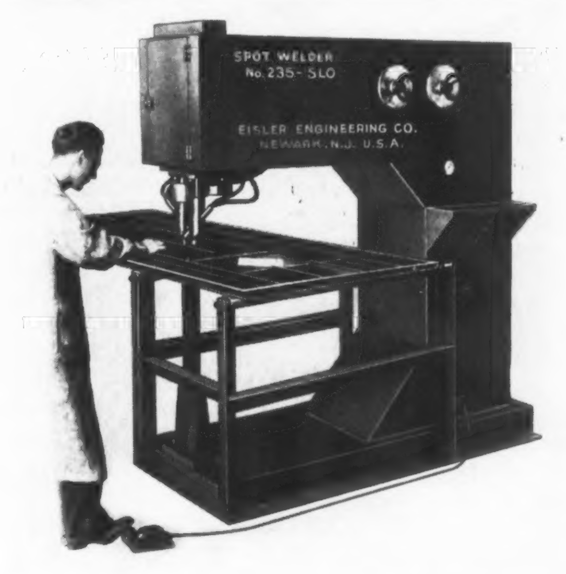


Fig. 1. Eisler Spot-welder for Materials that are Veneered, Lacquered, etc., on One Side

Sheldon Lathes with Motor Drive

The 10-inch lathes built by the Sheldon Machine Co., 3253-55 Cottage Grove Ave., Chicago, Ill., can now be furnished with a motor drive, either enclosed in a cabinet leg, as shown, or attached directly to the under side of a bench when the lathe is of the bench type. The driving unit provides four speeds through two positive clutches on the drive-shaft. These clutches are operated by the two levers that may be seen at the front of the cabinet leg.

There are eight spindle speeds, four direct and four obtained through back-gears. In making speed changes, it is only necessary to turn the clutch levers. The cabinet leg is provided with a large door to enable the operator to oil the unit and adjust the V-belt tension when necessary.

The 10-inch lathes swing 10 1/4 inches over the ways and are furnished in two bed lengths having maximum center distances of 20 and 26 inches. They are furnished with semi-quick-change gear-boxes and the necessary gears for cutting from four to eighty threads per inch. 60

Eisler Electric Spot-Welders

An electric spot-welder, shown in Fig. 1, has been developed by the Eisler Engineering Co., Inc., 750 S. 13th St., Newark, N. J., for welding materials that are veneered, lacquered, painted, or coated on one side. In the overhead welding method employed by this machine, both electrodes come in contact with the metal on the unfinished side only. Thus the finished surface is not burned or blistered.

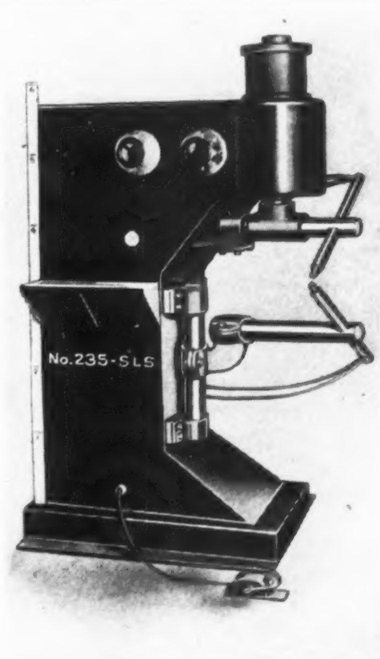


Fig. 2. Eisler Spot-welder Built in Capacities of 75 to 250 K.V.A.

The welder is of 125 kilovolt-ampere capacity, but equipment of this type can be built in many sizes to suit the material being handled. The machine is air-operated through a foot-switch and solenoid-controlled air valve. The transformer is air-cooled and has twenty-four points of current regulation. A table with rollers can be provided for handling large sheets of metal.

Another welder recently developed by the same concern in capacities from 75 to 250 kilovolt amperes is shown in Fig. 2. This welder is also air-operated, being controlled through a magnetic valve, foot-operated switch, and automatic timer and contactor. This welder is supplied with either an air- or water-cooled transformer, depending upon the size. There is a vertical adjustment for the bottom arm, and both the top and bottom arms can be turned to any position. The electrode-holders are water-cooled. 61

To obtain additional information on equipment described on this page, see lower part of page 206.

Sellers Horizontal Boring, Drilling, and Milling Machine

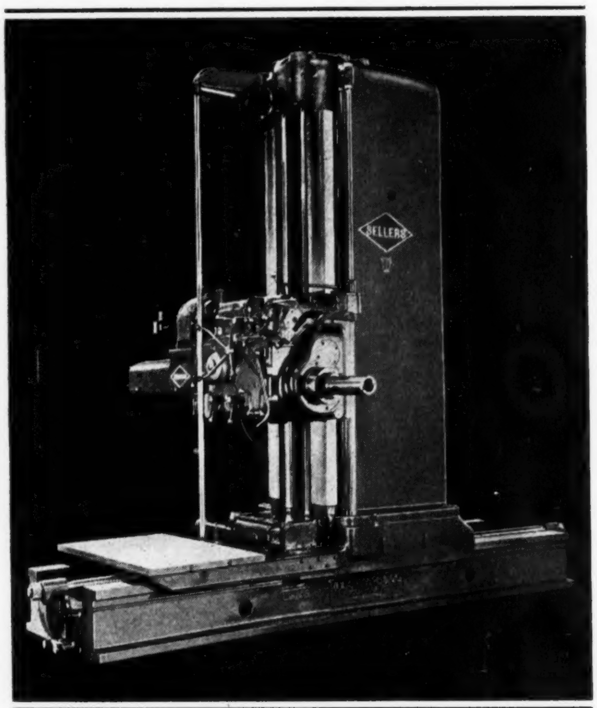
The spindle head of 4- and 5-inch floor type horizontal boring, drilling, and milling machines recently developed by William Sellers & Co., Inc., 1600 Hamilton St., Philadelphia, Pa., is a complete power unit. The driving motor is mounted on the head for transmitting power direct to the spindle through spur gears. The head contains the forward and reverse driving clutches and all mechanism for effecting speed and feed changes and hand or power traverse to both spindles, the head, the saddle, and the table. The feed and traverse mechanism and the driving mechanism are removable built-in units.

The operator completely controls the machine from his normal working position at the spindle and only four levers are required for complete control. There is the same convenience of control whether the head is high or low on the column.

The machine can be built with or without a high-speed auxiliary spindle. The head is clamped to the column from front to back and from right to left. Three tapered gibs insure alignment of the head on the column, and the unusually wide distance across the ways, together with the wide ways provided, insures alignment under heavy cuts.

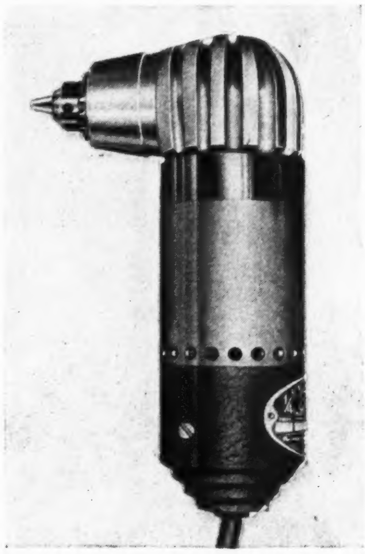
The screw feed furnished for the main slow-speed spindle insures a smooth even feeding action in taking both heavy and fine cuts. A rack-and-pinion feed is provided for the sensitive auxiliary spindle for tapping operations. A precision lead-screw enables accurate thread cutting to be done.

Twenty-four feeds ranging from 0.0025 to 0.625 inch are available and twenty-four speeds on the 4-inch machine ranging from 8.8 to 500 R.P.M. without the auxiliary spindle, and from 8.8 to 1500 R.P.M. with the auxiliary spindle. On the 5-inch machine, there are twenty-four speeds, from 5.8 to 333 R.P.M. without the auxiliary spindle, and from 5.8 to 1000 R.P.M. when the auxiliary spindle is provided. 62



Sellers Floor Type Boring, Drilling, and Milling Machine of Unit-head Construction

"Shorty" Ball-Bearing Electric Drill



Electric Drill with Spindle at Right Angles to Motor

The Black & Decker Mfg. Co., Towson, Md., has brought out an electric drill of an unusual design in which the chuck spindle is at right angles to the motor. With this construction, the over-all working length of the tool is only 4 1/2 inches, which makes the drill adaptable for use in close quarters that would be inaccessible to a longer tool. The motor housing dimensions have also been reduced to a minimum. The tool fits snugly in the operator's hand and requires no extra handle. The over-all length in the direction of the motor is 7 3/4 inches.

This drill is available in two sizes, having capacities for drilling up to 3/16 and 1/4 inch in steel. A universal motor is supplied for operation on alternating or direct current of 110 volts, but the drill is also available for 220 or 250 volts. The ventilating arrangement insures cool operation. Deep vents cast in the gear-head provide for the free passage of air even though the tool is grasped by the head. The tapered end of the gear-head extends over the chuck to protect the operator's fingers. A Jacobs gear chuck is standard equipment.

The drill is equipped with ball bearings throughout. A removable insulated cap permits easy access to the motor brushes for inspection. The tool is intended especially for use in aircraft, radio, and automobile-trim plants, and in the fabrication of ornamental iron and structural steel. 63

To obtain additional information on equipment described on this page, see lower part of page 206.

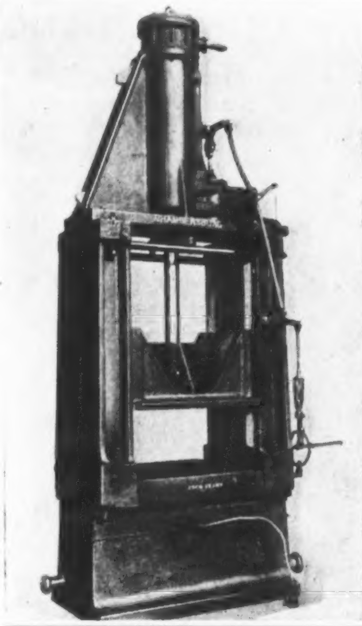
Cecostamp—an Air-Operated Hammer for Light-Weight, High-Strength Metals

A pneumatic hammer intended for the forming of light-weight, high-strength metal parts such as are used extensively in the aircraft industry and in the building of streamline railroad trains is being placed on the market by the Chambersburg Engineering Co., Chambersburg, Pa. This machine is suitable for the production of such typical aircraft parts as instrument panels, wheel fairings, exhaust stacks, fuselage rings, wing tips, ribs, channels, and fittings. The hammer, which is known as the Cecostamp, is built in a wide range of sizes, the smallest of which has a working face on the anvil and ram measuring 41 by 36 inches, and the largest, up to the present time, a working surface on the members mentioned of 120 inches square.

Drawing or stamping operations on this machine are controlled through a single lever, which governs the direction and speed of the ram. This lever, which provides a sensitive control, is pivoted so that it is accessible from the most convenient working position for each die. As will be seen from the illustration, the frame is made from I-beam sections, mounted rigidly on the anvil. Four I-beams maintain accurate guidance of the ram when dies of unusual shape are being used.

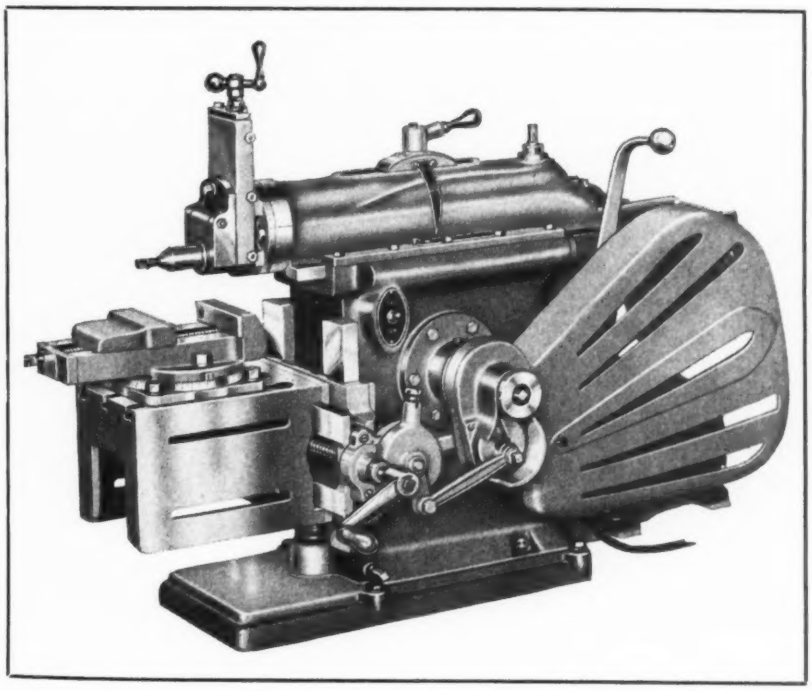
The cylinder is a Cecolloy casting which embodies self-draining and safety valve features. It is equipped with a safety cover, which provides a cushion of live air at the top of the cylinder that is not subject to the pumping of the hammer. This limits the stroke, protects the cylinder, and eliminates the hazard of broken cylinder covers in case a piston-rod should break or loosen.

The operator must keep his foot on the pedal to keep the ram in motion. Removal of his foot from the pedal causes safety latches to project under the ram and keep it raised. These safety latches can also be used to maintain the ram in either of two raised positions while the operator is working on dies and during loading. The safety latches are pneumatically actuated.



"Cecostamp" for Forming Sheet Metal Parts

The hammer is designed to employ the lead and zinc dies that have been used on rope lift gravity drop hammers. 64



Bench Shaper Added to the Line of the Atlas Press Co.

Atlas Bench Shaper

A bench shaper designed to handle a variety of small work economically is the latest addition to the line made by the Atlas Press Co., 1053 N. Pitcher St., Kalamazoo, Mich. The ram-driving mechanism is of the bull-gear type, with a quick return stroke. The stroke range is from 1/2 inch to 7 3/8 inches, and there are four speeds ranging from 45 to 200 strokes per minute.

Five automatic cross-feeds from 0.005 to 0.025 inch per stroke are available in either direction. The cutting speeds range from 3 1/2 to 116 feet per minute. The table has a horizontal travel of 8 1/2 inches and a vertical travel of 4 1/2 inches. The maximum distance from the table to the ram is 5 1/8 inches. The shaper is designed to be run by a 1/2-horsepower motor having a speed of 1740 revolutions per minute. The drive from the motor to the bull-gear spindle is by V-belt. 65

To obtain additional information on equipment described on this page, see lower part of page 206.

Colonial Broaching Machine for Spiral Gears and Pump Bodies

A standard vertical pull-up type of machine was recently supplied by the Colonial Broach Co., Detroit, Mich., for broaching both spiral internal gears and five different sizes of pump bodies. The machine has a stroke of 48 inches and is of 10 tons capacity.

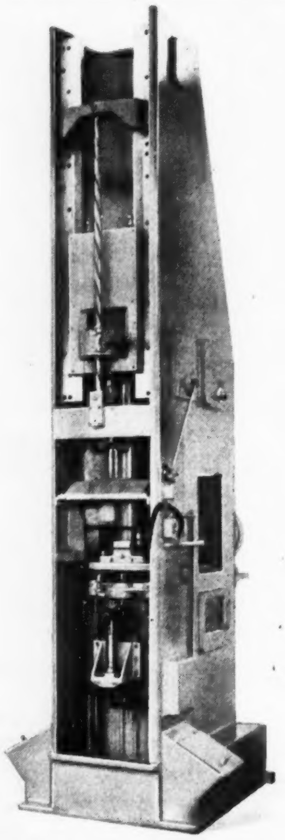


Fig. 1. Machine that Broaches Spiral Gears and Pump Bodies

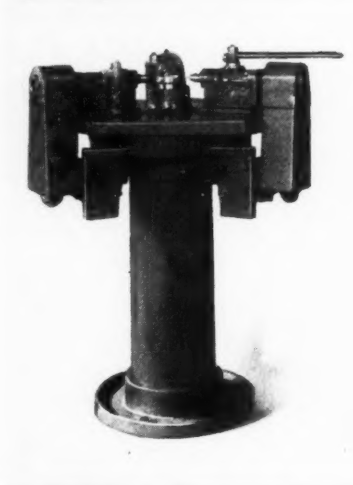
In Fig. 1, this machine is shown with the lower cover plate removed to expose the mechanism. The spiral bar on the front of the machine rotates the broach during the cutting of the internal spiral teeth in the gears. This spiral bar is instantaneously engaged or disengaged by means of the lever on the ram head near the bottom of the bar.

Slots are broached in the pump bodies, as indicated in Fig. 2, which shows typical parts before and after broaching. In broaching the pump bodies, the part is first loaded into the fixture and then the machine automatically brings the broach up from the bottom to engage the automatic puller in the ram. The broach is next pulled through the work, the machine stopping at the top of the stroke. After the work has been removed, the broach is returned to the base of the machine, where it is released and the machine is automatically reset for reloading.

The stroke is adjustable so as to permit the use of a shorter stroke in broaching the pump bodies than in broaching the gears. The latter are of steel, whereas the pump bodies are made of an alloy cast iron. 66

Langelier Three-Way Drilling Machine

A three-way machine for drilling holes 120 degrees apart has been built by the Langelier Mfg. Co., Providence, R. I., in the design here illustrated. This machine is constructed with three horizontal hand-fed units, so interconnected that the heads will feed the drills simultaneously to work held in fixtures on the machine table. The heads are driven by individual motors.



Langelier Small Three-way Drilling Machine

The machine can be arranged for tapping operations by using reversing tapping chucks. When the machine is to handle both drilling and tapping work, cone pulleys are provided in order to permit changing the spindle speeds. 67

Noble & Westbrook Marking Machine

A high-production marking machine has been designed by the Noble & Westbrook Mfg. Co., 20 Westbrook St., East Hartford, Conn., for marking chuck bodies of the type seen at the left in the illustration. The machine is power-operated, and all that is required of the operator

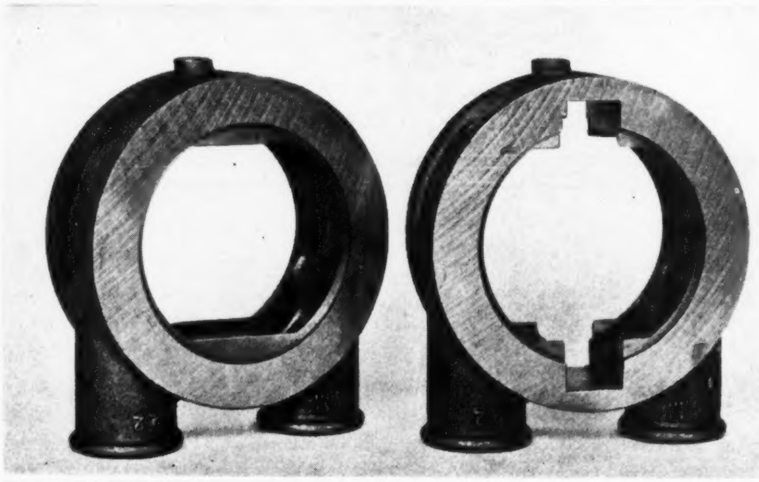


Fig. 2. Pump Bodies before and after the Broaching of Slots

To obtain additional information on equipment described on this page, see lower part of page 206.

Machine for the High-production Marking of Metal Parts

is to place the work pieces in the feeding position.

The parts are carried to the marking dies by means of a revolving dial. The dies consist of three sets of numbering and descriptive marking segments, so arranged that the inscription is spaced centrally between holes in the part. Guide pins keep the part in the proper position.

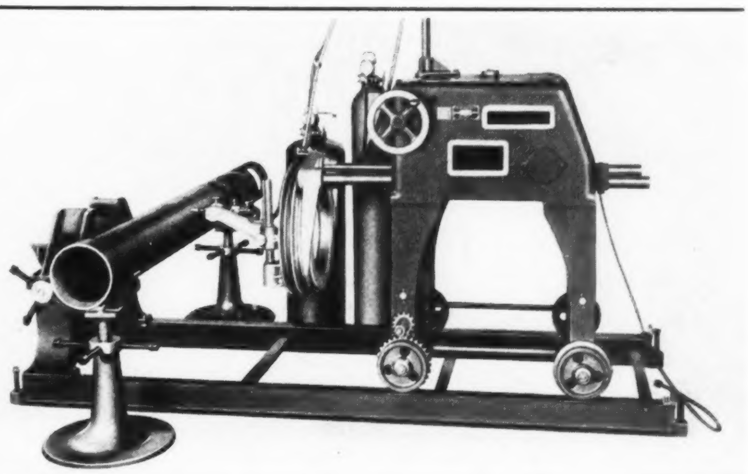
The carrying dial, which is also a pressure dial, is provided with a vertical adjustment for raising or lowering the inscription on the work pieces, and the dies can be adjusted individually for depth of inscription. Different die-holders are supplied to enable chuck bodies from 3/4 inch to 2 1/2 inches in diameter to be marked on the same machine. The marked pieces are unloaded automatically. 68

Oster Improved Torch-Cutting Machine

The Oster Mfg. Co., 2057 E. 61st Place, Cleveland, Ohio, has brought out a No. 222 improved torch-cutting machine that supersedes the original Model No. 212. The new machine will duplicate any pattern required for pipe welding jobs without the use of cams, templets, or special fixtures.

The cutting torch is guided by a mechanism that duplicates the motion of a torch held in the operator's hand. Pipe from 2 1/2 to 12 inches can be cut to various shapes, and hole cutting can also be performed. The pipe to be cut is centered in a vise and supported by roller rests while straight cutting for butt or tee welding. However, if a hole is to be cut, the pipe is placed at right angles to the torch-carrier on the roller rests.

The settings of the generating mechanism are regulated by positioning a rotating beam or lever which operates a reciprocating slide. The latter, in turn, controls the movement of an oscillating lever which reproduces the movement in the torch-carrier. The lever is rotated by means of a handwheel. 69



Oster Torch-cutting Machine of Improved Construction

Logan Sure-Flow Centrifugal Pump

A self-priming centrifugal pump, no part of which need be submerged and which requires no accessories such as an auxiliary priming reservoir, foot or check valves, has been brought

Logan Centrifugal Pump with Direct Motor Drive

out by Logansport Machine, Inc., Logansport, Ind. The impeller of this pump is semi-scavenging in action which, together with improvements in the liquid chamber and passages, results in a suction lift that enables this pump to handle liquids at temperatures up to the boiling point. Installation is simplified, as the pump can be mounted at the point of greatest convenience near the job and piped to the source of supply.

Liquids charged with abrasives, chips, filings, and many corrosive impurities can be safely handled. The drive-shaft and bearings of the pump are protected from the liquid by rotary seals. The pump is made in ten sizes having capacities ranging from 4 to 150 gallons per minute. The pump can be driven direct from a motor by a stub

To obtain additional information on equipment described on this page, see lower part of page 206.

shaft adapter which provides a vertical power take-off or by a belt. Three mounting styles are available—a horizontal base, a vertical mounting bracket, and a flange type base for close mounting in a vertical plane.

The pump is completely self-contained and is of unusually small proportions in each of the ten sizes. 70

Mauser Toolmaker's Calipers

Mauser toolmaker's calipers with measuring capacities of 7, 9, and 11 inches have been made available in this country by the George Scherr Co., 124 Lafayette St., New York City. These calipers, which can be applied as shown in the illustration, and also as a height gage by attaching the base to one jaw and the scribing attachment to the other, are graduated to 1/1000 and 1/128 inch. Use of the tool as a height gage was illustrated in July, 1935, page 700.

The base is much heavier and of larger area than on previous Mauser calipers, so that the height gage rests firmly on surface plates without the possibility of tilting. The vernier caliper has two knife edges which are practical for lay-out work, for measuring distances between holes, and for measuring the root diameter of gears, as well as for making many other precise measurements.

The steel point of the scribing attachment is adjustable, so that it is possible to set the height gage at an even figure on the scale in making measurements. This reduces calculations and saves time. 71

Stow Three-Speed Suspended Flexible-Shaft Unit

A three-speed flexible-shaft unit known as "Assembly V" has been brought out by the Stow Mfg. Co., Inc., Binghamton, N. Y., for use in shops where floor space is at a premium. This unit may be mounted on a trolley or suspended from a hook. It comprises a ball-bearing motor and a ball-bearing countershaft. The countershaft is provided with a screw for adjusting the belt tension.

Standard equipment includes a ball-bearing hand-piece with a clamp spindle for holding grinding wheels, buffs, scratch-brushes, etc. Angle-heads and special hand-pieces can be furnished, which are interchangeable with the standard hand-piece.

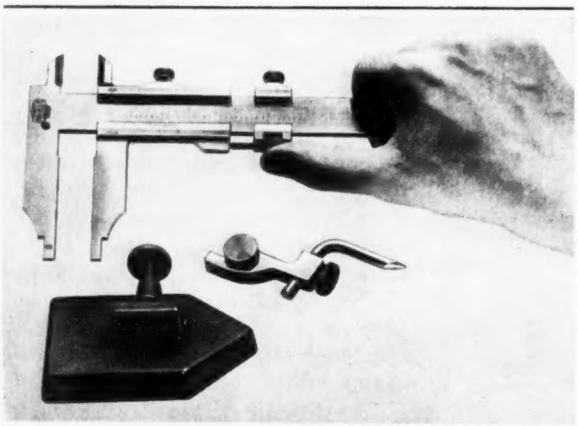
Units of this type are available in ratings of 1/8, 1/4, 1/2, and 1 horsepower, and except the largest size, with operating speeds of 900, 1725, and 3400 revolutions per minute, or 1800, 3425, and 6800 revolutions per minute. The largest size is ordinarily made with the high range of speeds. 72

Equipment for Automatically Dispensing Brazing Flux

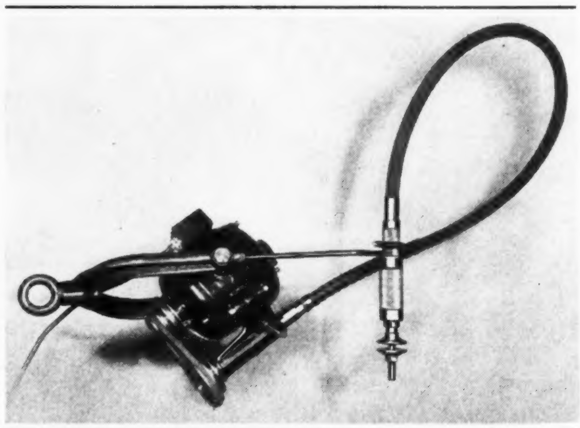
Automatic Fluxing Machine

The Automatic Gasflux Co., 620 Frankfort Ave., Cleveland, Ohio, has placed a machine on the market that automatically dispenses brazing flux. Gas passing through this equipment is impregnated with the flux. The flux then travels with the gas to a torch tip and is expelled in the flame.

The flux used has a low melting point and is dispensed in a minimum quantity. It creeps ahead of the brazing puddle. The flux penetrates quickly. 73



Mauser Toolmaker's Caliper Available in Measuring Capacities of 7, 9, and 11 Inches



Stow Flexible-shaft Unit which has Three Speeds of Operation

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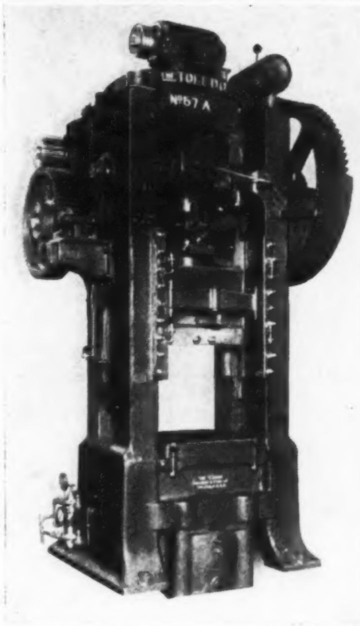


Press with Die Cushion which Doubles Blank-holding Pressure

Toledo Press with Hydro-Pneumatic Die Cushion

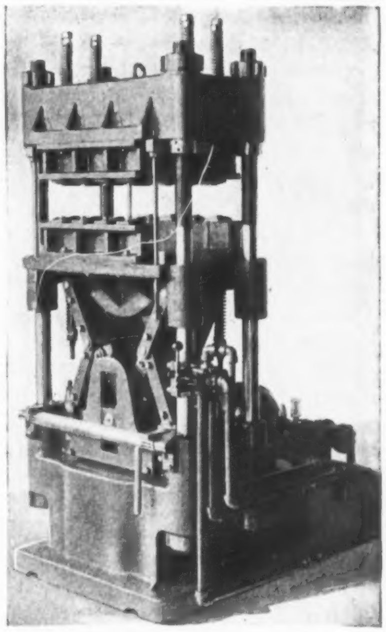
A single-action press fitted with a semi-built-in heavy-duty Marquette hydro-pneumatic die cushion has recently been built by the Toledo Machine & Tool Co., Toledo, Ohio, a Division of the E. W. Bliss Co. This cushion gives about double the normal blank-holding pressure, and thus adapts the machine to shape-stretching jobs requiring a high gripping pressure around the edge of the blank. In such work, it is possible to use gripping pressures exceeding the drawing pressure.

The press itself is double-geared and has a single-end drive. A gear ratio of 16 to 1 gives a speed of 22 strokes a minute. A 10-horsepower high-slip motor drives the flywheel by means of V-belts. The stroke is 10 inches, and the self-contained cushion enables shells up to 4 3/4 inches high to be drawn. 74

Improved Molding Presses

Improvements have been made recently in the self-contained molding presses built by the Standard Machinery Co., Mystic, Conn., which enable these presses to be easily adapted to a wide range of pressures. The maximum or total rated capacity of the new presses can be reduced by making one or two simple adjustments. An adjustment in the high-pressure pump release valve changes the pressure delivered on the platen of the pump from its total capacity to any desired point down to approximately one-third of its rated capacity. The same results can be accomplished by lowering the position of the "thrust" block. An indicator attached to the block and a pressure scale on the guide facilitate this adjustment.

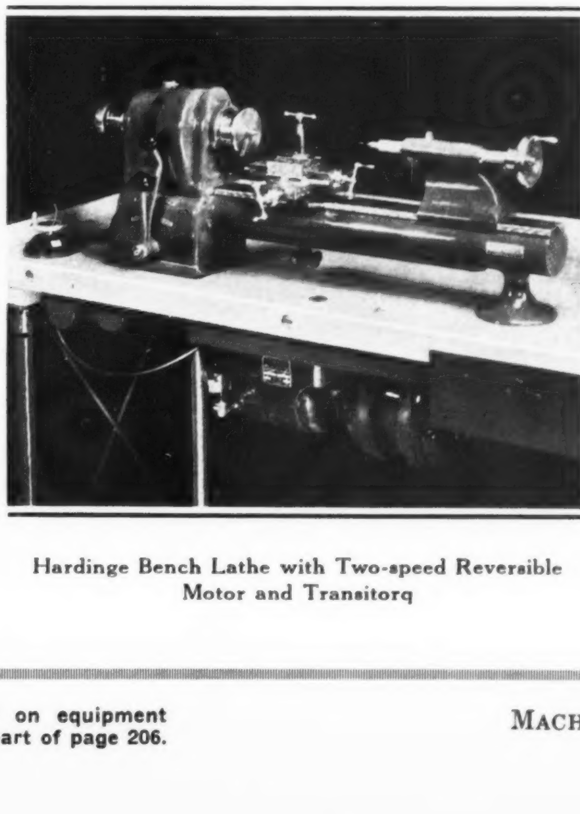
These two adjusting features are of especial advantage to shops handling diversified work that requires a wide range of pressures. Custom molders, for example, often find it necessary to use less pressure than the rated capacity of the only press available for handling a mold of the required area. These presses are made in 50-, 100-, 150- and 300-ton models. 75



"Standard" Molding Press with Pressure-adjustment Feature

Hardinge Bench Lathe with Transitorq Drive

Bench lathes built by Hardinge Bros., Inc., Elmira, N. Y., can now be equipped with a drive consisting of a two-speed reversible motor and a New Departure Transitorq variable-speed transmission. The Transitorq has a 1 to 10 ratio between low and high speeds, while the two-speed motor has a 1 to 2 ratio. This arrangement provides low- and high-speed ranges.



Hardinge Bench Lathe with Two-speed Reversible Motor and Transitorq

The Transitorq handwheel at the left-hand end of the bench gives a speed variation from 150 to 3000 revolutions per minute; and for every setting of the Transitorq, two immediate speeds are available through the motor without the necessity of slowly turning the handwheel to get a low-high or high-low speed change. For example, with the Transitorq handwheel set for 1000 revolutions per minute,

To obtain additional information on equipment described on this page, see lower part of page 206.

changing the long headstock lever from the low to the high position instantly changes the speed to 2000 revolutions per minute and vice versa. The desired speeds are easily obtained by referring to the handwheel dial.

The long lever gives low and high speed changes and stops the spindle. The short lever gives forward and reverse speeds, brakes, and stops.

The Transitorq and motor are mounted on the under side of the bench toward the back, out of the way of the operator's knees. Provision is made for quick adjustment of belts. Bench lathes equipped in this manner are available in five sizes of from 1/2-inch to 1-inch collet capacity, with 7 or 9 inches swing. 76

Reeves Differential for Automatic Speed Control

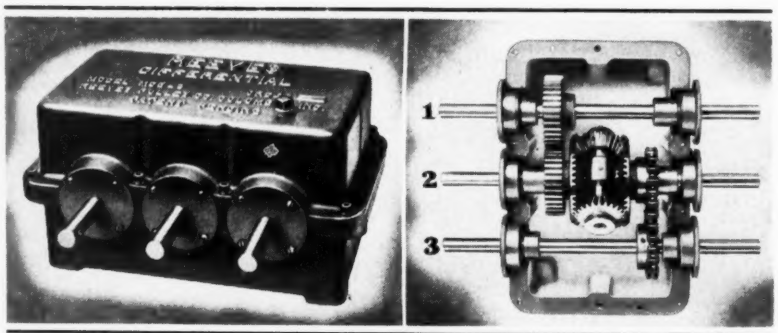
A new unit or accessory equipment for use with the Reeves variable-speed transmission has been brought out by the Reeves Pulley Co., Columbus, Ind. This unit, known as the Model MDB-3, is similar in its operating principle to the differential gearing of an automobile rear axle. It is designed to meet a variety of requirements in automatic speed control, being particularly adapted for the synchronization of two or more machines or members of a single machine. It will also maintain uniform peripheral winding or unwinding speeds.

The unit has three parallel shafts, arranged as shown at the right in the accompanying illustration. Gears of 1-to-1 ratio provide the drive between shaft 1 and the differential gearing. Between shaft 3 and the differential gearing is a 1-to-1 ratio chain drive. Other ratios are also available.

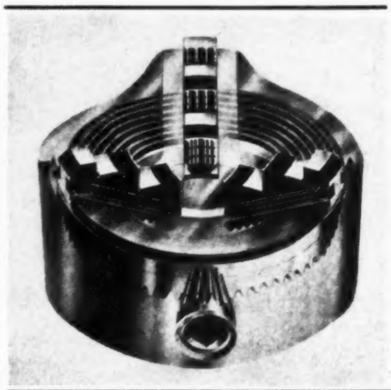
When used for automatic control service, shafts 1 and 3 are connected to the driven machine or machines, and shaft 2 is connected to the speed-changing screw of the Reeves transmission. When shafts 1 and 3 are driven in the same direction at the same speed, shaft 2 ceases to rotate. If the speed of the driven machine varies above or below the desired speed, this variation is transmitted to shaft 2 which speeds up or slows down the transmission until synchronous speed is restored. The mechanism runs in an oil bath.

The differential can also be used for primary driving purposes. For example, it can be used with other equipment to control indexing or registering movements obtained either manually or with photo-electric equipment.

An infinite range of speed variation is possible by connecting shafts 1 and 3 to the constant- and variable-speed shafts, respectively, of the transmission. By turning the speed-control handwheel on the transmission, shaft 2 can be stopped or adjusted to any speed in either direction. The shafts are extended on both sides of the housing to facilitate installation. The unit measures 8 by 11 inches. 77



Exterior and Interior Views of Differential Speed Control Unit for Reeves Variable-speed Transmissions



Taylor Scroll Chuck Sold by the George Scherr Co.

Taylor Self-Centering Scroll Chucks

Scroll chucks of the construction shown by the phantom view in the accompanying illustration are being introduced to the trade by the George Scherr Co., 124 Lafayette St., New York City. All moving parts of these chucks are hardened and ground. One of the advantages of the construction is unusual gripping power. Work cannot slip and cause breakage of carbide tools.

The front face of the chuck body is in the form of a hollow cone. Ways for the jaws to slide in are cut in this face. In all sizes above 8 1/2 inches, the central portion of the chuck body passes right through the back of the chuck to give maximum strength with minimum depth. The back of the chuck holds the internal working parts and contains a recess for locating the adapter.

The spiral member has teeth in the back and is revolved by one of three pinions. The front face is also in the form of a hollow cone, and has a spiral V-thread which engages teeth cut in the back of the jaws. The jaws are advanced or withdrawn simultaneously to grip the work. They are supported immediately behind and at right angles to the line of pressure that occurs in gripping the work. The construction of the chuck makes it impossible to strip or bend the teeth at the back of the jaws or to tear out the jaw ways in the chuck body.

To obtain additional information on equipment described on this page, see lower part of page 206.

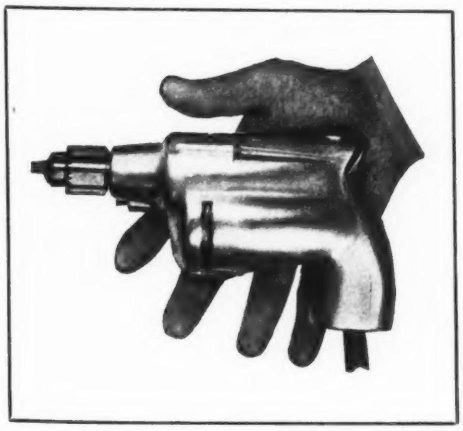
Two types of jaws are usually supplied. One type is intended for general lathe work, and the other for holding bars, etc. Jaw blanks are available with the front left soft to permit them to be machined to suit the holding of odd-shaped work. The teeth at the back and the surfaces that slide in the chuck body, however, are hardened, and the sliding surfaces are ground.

This scroll chuck is made in standard sizes for holding work from 4 1/2 to 20 inches outside diameter. 78

Dyno-Mite Portable Electric Drill

A portable electric drill of streamline design and a weight of only 2 1/2 pounds has been placed on the market by the Millers Falls Co., Greenfield, Mass., for drilling holes up to 1/4 inch in steel. This drill has an over-all length of only 8 inches and a width of 2 1/2 inches, its small size permitting it to be used in close quarters.

The die-cast aluminum shell houses a motor equipped with a ball-bearing armature that runs in a horseshoe field. The helical gears used in the drive are of heat-treated chromium-molybdenum steel. The spindle runs in an Oilite bearing and is also equipped with a ball thrust bearing. Air flows over the important parts to insure cool operating temperatures.

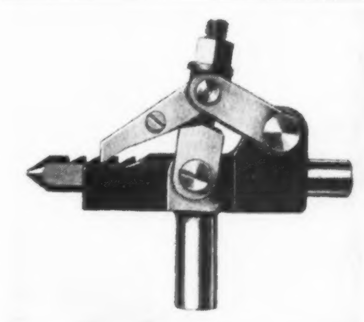


Streamline Quarter-inch Drill Made by Millers Falls Co.

The motor can be operated on direct current or on alternating current up to 60 cycles and on voltages of 110 or 220. A Jacobs chuck is standard equipment. The no-load speed is 1600 revolutions per minute, and the full-load speed 875 revolutions per minute. 79

Clampco Toggle Planer Clamp

A planer clamp with a toggle locking arrangement designed to save set-up time is being placed on the market by the Howe Machinery Co., Inc., 30 Gregory Ave., Passaic, N. J. This clamp is made with a shank that is inserted into the holes of planer tables. Then the clamping bar is pushed against the work, and a nut tightened to force a toggle pawl downward into ratchet-like slots cut across the top of the clamping bar.



Planer Clamp with Toggle Locking Arrangement

This action forces the clamping bar firmly against the work, and as the bar is inclined toward the work at an angle of 3 degrees, the work is securely held down on the planer table.

The clamp is made with different sizes of shanks and also with a self-locking head to fit the T-slots of machine tool tables. It can also be supplied with a flat base for clamping work in jigs. 80

"Unbrako" Self-locking Set-screw

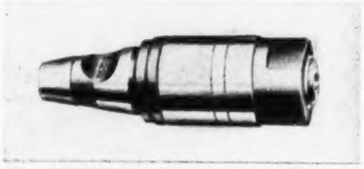
"Unbrako" Self-Locking Hollow Set-Screw

A self-locking hollow set-screw having the top threads knurled, as shown in the accompanying illustration, to provide the locking feature has been brought out by the Standard Pressed Steel Co., Jenkintown, Pa. By knurling the upper end of the thread at an angle, as shown, the metal is swaged to the upper side, and this feature, along with the clearance provided between the threads, eliminates resistance when the screw is being inserted.

When the set-screw is tightened and its locking or knurled threads engage those of the tapped hole, the cup point of the set-screw is forced into the shaft, the same as an ordinary set-screw. The upper sides of the knurled threads back up against the sides of the threads of the tapped hole with a pressure that increases as the cup point is driven deeper into the shaft. The prongs at the upper ends of the knurled serrations then dig into the threads of the tapped hole, thereby effectually locking the set-screw.

This self-locking set-screw works equally well in steel, cast iron, bronze, and brass. The first application is naturally the most efficient, as backing off causes the locking prongs to wear. It is possible, however, to back off the screws several times before the locking qualities are lost. 81

To obtain additional information on equipment described on this page, see lower part of page 206.



Cam-lock Arbor Brought out by the Brown & Sharpe Mfg. Co. for Use with Small Cutters

Brown & Sharpe Cam-Lock Arbor

A cam-lock arbor brought out by the Brown & Sharpe Mfg. Co., Providence, R. I., makes it possible to use certain small milling and other cutters with cam-lock adapters to provide the same advantages of positive drive and quick cutter changing that is afforded by the Brown & Sharpe cam-lock cutter adapters. This arbor is made in two sizes of 7/8 inch and 1 inch diameter. Each size is 2 inches long from the shoulder to the nut, and is intended for use in holes of milling machine standard taper No. 30. 82

Baldor Grinder for Carbide Tools

The Baldor Electric Co., 4357 Duncan Ave., St. Louis, Mo., has recently developed a grinder primarily for sharpening carbide-tipped tools. This machine is equipped with two wheels, one for rough operations and the other for finishing operations. A silicon cup-wheel is mounted on the left-hand side of the machine and either a silicon or a diamond cup-wheel on the right-hand side of the grinder.

This machine is driven by a 1/2-horsepower reversible motor, which enables either right-hand or left-hand tools to be sharpened with the wheel rotating toward the cutting edge of the tool.

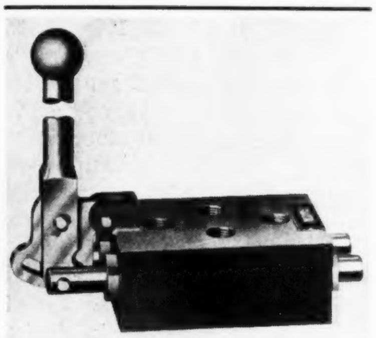
Standard equipment includes tool-rest tables that measure 10 by 3 1/2 inches, a protractor at each end of the grinder for indicating the angle of the tool table, a light that may be swung over either wheel, and tool supports, attached to the tool-rest table. 83

Baldor Grinder for Sharpening Carbide-tipped Tools

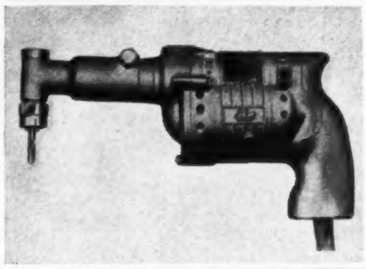
Hunt Solid-Steel Slab Hydraulic Valve

A hydraulic valve with a housing machined from a solid steel slab has been placed on the market by C. B. Hunt & Son's Co., Salem, Ohio. It is made in two types for working pressures of 1000 and 2000 pounds, and also in two-way, three-way, and four-way designs. The three-way and four-way valves have only two internal parts for the valving action.

This new valve is so designed that piping connections can be made either above or below. The entire valve assembly, cylinder, and lever mechanism can be removed and replaced in a few minutes. Pipe connections need not be disturbed for inspection purposes. The valve is available in sizes of from 1/2 inch to 1 1/2 inches. 84



Hunt Hydraulic Valve with Housing Machined from Solid Steel



Small Electric Drill Designed for Close-quarter Use

Thor Right-Angle Electric Drill

A right-angle electric drill of 3/16 inch capacity has been brought out by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., for close-quarter drilling. This addition to the Thor line weighs only three pounds and measures 9 1/4 inches over all. The angle attachment can be turned and clamped in any position.

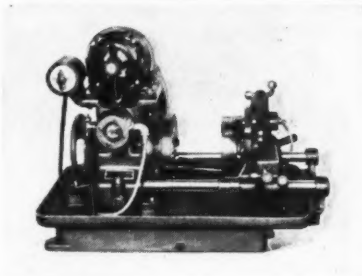
This drill is equipped with collets for twist drills from 1/16 to 3/16 inch, and it can also be supplied with a spindle to take a 3/16-inch chuck. The drill can be supplied to operate at speeds of 2700, 3750, or 5100 revolutions per minute. 85

Tom Thumb Portable Pipe Machine

A model 512-A pipe machine has been brought out by the Oster Mfg. Co., 2057 E. 61st Place, Cleveland, Ohio, to round out the Tom Thumb line of portable pipe machines, which now comprises machines from 1/2 inch to 2 inches in capacity. The new machine is equipped with a die-head that is integral with the carriage, so that the threading dies are rigidly supported and their life lengthened.

The die-head is of the front-cutting type which, together with the close-grip front chuck, makes it possible to handle pieces as short as 2 1/2 inches without using a nipple chuck. The size setting marks are on top of the head, where they are plainly visible. Oil is supplied

To obtain additional information on equipment described on this page, see lower part of page 206.



Portable Pipe Machine Added to the Tom Thumb Line

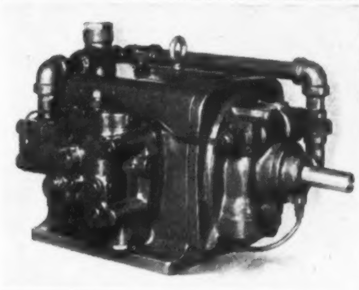


Fig. 1. Oilgear Variable-displacement Duplex Pump

Fig. 2. Duplex Pump of the Constant Displacement Type

to the dies and the cut-off tool by means of an internal oiling system.

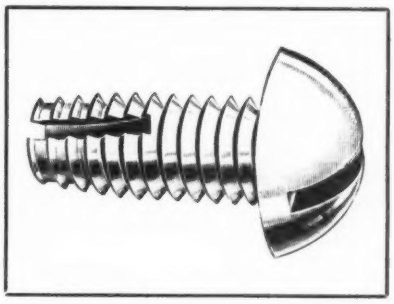
The holder for the cut-off, reaming, and chamfering tools is operated in a heavy block by means of a ball-crank. The steadyrest is also supported by a heavy rectangular block and operated by a ball-crank. 86

Holo-Krome Socket-Screw Wrench Set

Nine "File Hard" surfaced socket-screw wrenches are included in a set, designated as No. 22, which is being placed on the market by the Holo-Krome Screw Corporation, Hartford, Conn. These wrenches fit hexagon hollow set-screws from No. 8 to 3/4 inch diameter, inclusive; socket-head cap-screws from No. 8 to 1/2 inch diameter, inclusive; socket-head stripper bolts from 3/8 to 3/4 inch diameter, inclusive; and hollow pipe plugs from 1/8 to 1/2 inch diameter, inclusive.

The wrenches are supplied in a compact black crackle-finish metal box made with a hinged cover. The box measures 5 inches by 2 3/4 inches by 5/8 inch....87

New Holo-Krome Set of Socket-screw Wrenches



Shakeproof Screw which Cuts its Own Thread

Thread-Cutting Screws with Standard Machine Screw Thread

A screw that actually cuts its own thread in metals and plastics of practically any thickness is a recent development of the Shakeproof Lock Washer Co., 2501 N. Keeler Ave., Chicago, Ill. A patented thread-cutting slot incorporated in these screws and a special hardening process impart features that eliminate the separate tapping operation required with standard screws.

The screw remains in the threads it has cut, but can be replaced by an ordinary machine screw of the same size, if necessary. The thread-cutting screws are made in sizes from No. 4–40 threads per inch up to 3/8 inch–16 threads per inch. 88

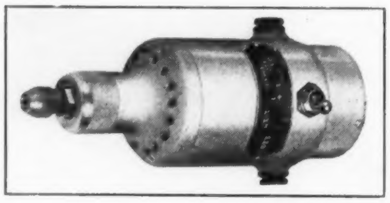
Oilgear Fluid-Power Duplex Pumps

High-speed rapid traverse at pressures up to 300 pounds per square inch and slower working speeds at pressures up to 3000 pounds per square inch are obtainable with the one-way variable- and constant-displacement pumps manufactured by the Oilgear Co., 1302 W. Bruce St., Milwaukee, Wis. Pumps of these types are available in ratings of from 2 to 60 horsepower.

Each unit is equipped with a low-pressure, constant-displacement gear pump. The combined discharge from this gear pump and from a radial piston pump provides a large volume for rapid traverse at pressures up to 300 pounds per square inch. When the maximum rapid traverse pressure is reached, the gear pump discharge is automatically by-passed and only the volume of the radial piston pump is discharged.

Standard combinations of these duplex units meet the requirements of a wide variety of applications. They are available with either a constant- or a variable-displacement high-pressure pumping unit, arranged to deliver oil in one direction. Both the low-pressure gear pump and the high-pressure radial piston pump are compactly arranged in one case. Fig. 1 shows a duplex variable-displacement pump without the reservoir, and Fig. 2 a duplex constant-displacement pump without the reservoir. A large variety of control devices can be supplied for use with these pumps. 89

To obtain additional information on equipment described on this page, see lower part of page 206.



Themac 1/8-inch Hand Grinder that Weighs Only Two Pounds

Themac Streamline Hand Grinder

The McGonegal Mfg. Co., 228 A Orchard St., East Rutherford, N. J., has brought out a hand grinder of streamline design which has a weight of only two pounds. This tool is equipped with a 1/15-horsepower universal motor for operation on alternating or on direct current at a speed of 18,000 revolutions per minute. The grinder can be equipped with 1/8- or 3/32-inch Themac collet chucks or 1/8-inch Jacobs chucks.

Three pencil type grinding wheels are regularly supplied. In addition to grinding, the tool can be used for drilling, engraving, polishing, carving, sawing, and routing. It can be employed for correcting inaccuracies in forging, forming, or blanking dies, removing fins from castings, and other operations. 90

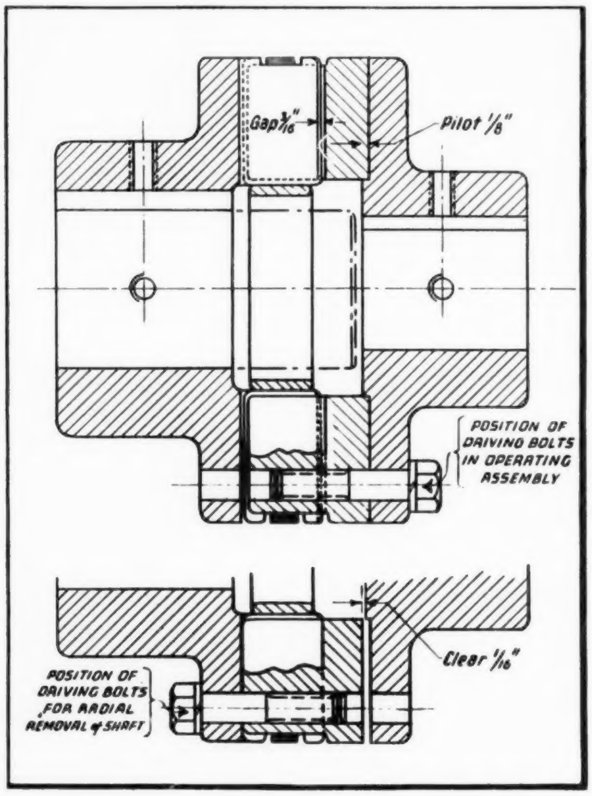
L-R Flexible Coupling with Axial Adjustment

The feature of an L-R Type WQ flexible coupling announced by the Lovejoy Flexible Coupling Co., 5021 W. Lake St., Chicago, Ill., is the fact that one set of jaws is made in the form of a removable ring. This ring is normally held in place and driven by hexagon-head cap-screws which operate from the jaw body.

The pilot that holds the jaw ring in place is 1/8 inch deep, as indicated in the upper view of the illustration, whereas the gap between the cushions and the jaw body is 3/16 inch. Thus, when the removable jaw is pulled over as shown in the lower view of the illustration, there is a clearance of 1/16 inch which permits rotating either half of the coupling with respect to the other half.

This independent rotation or adjustment is particularly advantageous in setting or timing gasoline, steam, and Diesel engines, which, of course, cannot be done with the machinery connected. Disconnection of the coupling halves, as described, can be accomplished by simply taking out the cap-screws and reversing them, so that they operate from the opposite body, as shown in the bottom view of the illustration.

This coupling operates on the L-R principle of carrying the load on free-floating cushions. Cushions of Metalflex, leather, and Multiflex are available. Type WQ couplings are made in standard sizes, with bores from 1 1/2 to 14 inches, for transmitting from 2 to 2000 horsepower at 100 R.P.M. 91



Drawings Showing the L-R Type WQ Flexible Coupling Assembled for Driving and Axial Adjusting

Cutting Tool with Brazed Tantaloy Tip

Tantaloy—A Tantalum-Carbide Cutting Alloy

A hard cutting-tool and wear-resisting alloy known as Tantaloy has been developed by the Fansteel Metallurgical Corporation, North Chicago, Ill. Tantaloy contains tantalum carbide, and possesses the characteristic of a high degree of chip slippage which resists the development of craters by the chip action. Little metal need be removed in sharpening operations.

Tools tipped with this alloy are suitable for service ordinarily regarded as severe, such as interrupted cuts, heavy feeds, and machining metal of varying hardness. They are available in all standard lathe, boring mill, and turret sizes. Tantaloy is also available in tips for brazing to boring-bars, counterbores, and special tools. The alloy is recommended, in addition, for gages, lathe centers, centerless grinder rests, and other parts that must be made from an abrasion- and corrosion-resisting metal. 92

To obtain additional information on equipment described on this page, see lower part of page 206.